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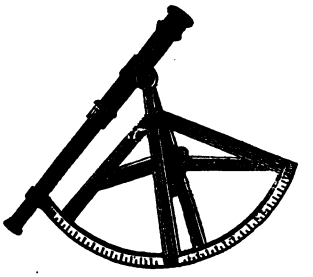
THE LONGITUDE
BY THE MERIDIAN ALTITUDE
WITHOUT THE AID
OF A CHRONOMETER.

[Entered at Stationers' Hall.]

LUCAS'S  TABLES

FOR

FINDING THE LONGITUDE

BY THE

MERIDIAN ALTITUDE,

AT SEA,

WITHOUT THE AID OF A CHRONOMETER;

INCLUDING

NEW AND CONCISE TABLES FOR WORKING THE SYSTEM,

TOGETHER WITH

A TABLE SHOWING THE DAILY VARIATION OF THE EQUATION OF TIME UNDER THE MERIDIAN OF GREENWICH.

BY WILLIAM LUCAS.

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PREFACE.

THE object of this work is to facilitate what navigators most desire, and to assist them in obtaining, within the shortest possible space of time, the necessary results required in conducting their ships. I have personally made it my study to secure this object when at sea, and experience has proved to me that the method I adopted, which is explained in this treatise, is such as I can with the greatest confidence recommend to others.

I propose means of finding the Longitude at sea by a Meridian Altitude, at noon, without the use of a chronometer. By the following method I can do this, in an inconceivably short space of time when compared with the ordinary method. I hereafter give as an illustration a few Examples of my mode, which Examples are novel to any in use.

I have established my system by test with that valuable invention, "Moore's Spherical or Great Circle Indicator," the inventor of which I sailed under many years ago. My plan is based on simple calculation, found to be correct by my own experience in the conduct of valuable ships and property at sea. Neither the method nor the Examples are recommended, as most works are, as theories. The method is founded on practice and developed by my own practical experience. Having submitted my system to the examination of the Marine Board in London, I decided on making a voyage as chief officer under the command of an experienced captain, so that I might give him the opportunity of investigating my plan, and herewith is annexed a certificate from him, which he personally ratified at the Mercantile Marine Board of London.

WILLIAM LUCAS.

Oct., 1864.

[COPY OF CERTIFICATE.]

"LONDON, *July* 27, 1864.

"This is to certify that William Lucas was mate of the barque 'Douglas,' under my command, in a voyage from Swansea to the West Indies, and back to London. I beg to recommend his method of finding Longitude by Meridian Altitude, having found it to correspond with my Chronometer.

(Signed) "JOSEPH S. SOPWITH,

"Master, barque 'Douglas.'"

ABBREVIATIONS.

Alt.	Altitude.
App.	Apparent.
App. T. S.	Apparent Time, Ship.
Equ. T.	Equation of Time.
Diff.	Difference.
Decl.	Declination.
Lat.	Latitude.
Long.	Longitude.
Merid.	Meridian.
M. T. S.	Mean Time, Ship.
M. T. G.	Mean Time, Greenwich.
P. D.	Polar Distance.
+	Add.
—	Subtract.
×	Multiply.
÷	Divide.
=	Equal to.

RULE AND EXAMPLES

FOR WORKING LUCAS'S SYSTEM.

RULE.

THE system set forth in the present work, is that of FINDING THE LONGITUDE BY THE MERIDIAN ALTITUDE, AT SEA, WITHOUT THE AID OF A CHRONOMETER. In order to do this, the following rule must be observed. First ascertain the Altitude, at noon, by means of the quadrant or sextant. Next ascertain mean time at Greenwich in this way:—Find the Altitude at Greenwich by working the Altitude back from the Latitude at Greenwich; and then take the Polar Distance at Greenwich and the Latitude at Greenwich, and with these three work as in the old form or system. Next find the Secant and Co-Secant, Co-Sine and Sine, as in the old system. Then take (when South 45°), half the Meridian Altitude at noon, and correct it by a correction which will be found in Example I. Then, with the Latitude and Polar Distance, Half Sum and Remainder, and work in the same way as in finding the mean time at Greenwich. This gives the apparent time at Ship; and applying the Equation as in the old system, brings it to mean time at ship. The difference between the mean time at ship and mean time at Greenwich is the Longitude, which is shown in the following Examples, as is also the mode of finding the corrections. There are two Examples, in which no correction is required, for finding the Longitude by the rising and setting of the sun. The mode of applying the Equation is also shown in these Examples.

EXAMPLES.

EXAMPLE I.

Proving that the Rule works for intermediate days.

BARBADOES, June 5th, 1864.

	°	′	
Noon's alt.	80	29	
Greenwich alt.	61	8	
	19	21	Diff. between Greenwich alt. and noon's alt., from which the correction is found, as laid down, thus:—
Noon's alt.	80	29	
½)	61	08	
	30	34	
Add +	2	25	Correction.
Corrected alt	32	59	
	13	5	
Polar Dis.	67	24	
Sum	113	28	
Half Sum	56	44	
Remainder	23	45	

	°	′
½)	19	21
½)	9	10
½)	4	55
	2	25 .. Correction.

Secant	0·114
Co-Secant	0·347
Co-Sine	4·7392
Sine	4·6050
	9·3903

	h.	m.	s.
	20	2	25
Equation .. —		1	12
	20	1	13
	24	00	00
	3	58	47

59·42 Long. West.

EXAMPLE II.

Showing how Greenwich Mean Time is found. This Example differs from Example I., eight miles, owing to the Equation being additive.

	°	′		°	′		°	′		
Noon's alt....	88	33	½)	38	23		51	28		
Green. alt.....	50	10	½)	19	11		90	00		
	38	23	½)	9	35		38	32		
	88	33	½)	4	47		11	38		
	½)50	10				Alt.....	50	10		
						Lat.....	51	28	Secant....	2055..Log.
	25	5		2	23	P. Dist...	111	38	Co-Secant	0090..Log.
	+ 7	10		7	10		½)213	16		
	32	15								
	13	5	Secant....	0114		H. Sum.	106	38		4·4567..Log.
	78	22	Co-Secant	0090		Remain...	56	28		4·9209..Log.
	123	42					18	50	20	= 9·5921
	61	51	Sine ..	4·6737			5	9	40	
	29	36	Co-Sine	4·6936						
				9·3877			24	00	00	

	h.	m.	s.
	20	3	14
	24	00	00
	3	56	46
Eq. +		2	35
	3	59	21

59·50 Long. West.

EXAMPLE III.

The Greenwich time is found as in the First Example—24 00 00.

SATURDAY, July 9th, 1864.

	°	′		°	′		°	′
Noon's alt...	71	45						
		12						
	½)71	57		+17	=59		53	57
	+½)35	58		35	58		−4	29
	+½)17	59		53	57		49	=28
	½) 8	59	Alt.....	49	28			
	+½) 4	29	Lat....	40	21	Secant....	1179	
			P. Dist..	67	42	Co-Secant	0337	
	2	14		157	31			
			H. Sum.	78	45	Sine ..	4·2902	
			Remain.	29	17	Co-Sine	4·6894	
							9·1312	

	h.	m.	s.		h.	m.	s.	
	21	7	21		21	7	21	
	24	00	00		+	4	56	
	2	52	39		21	12	17	
Equation....	—	4	56		24	00	00	
	2	47	43	41·56 Long.	2	47	43	41·56 Long.

EXAMPLE IV.

The following altitudes were taken in the forenoon, on the given day, to work the chronometer (32·13).

	°	′		
	32	13		
	40	10	Secant ..	1168
	67	42	Co-Secant .	0337
	140	5		
	70	2	Sine	4·5333
	37	49	Co-Sine .	4·7875
				9·4713

	h.	m.	s.
	19	36	25
Equation.... +		4	56
	19	41	21
G. Time	22	31	46
	2	50	25

42	36	
	34	What the ship has run to noon.
42	02	Differing from the meridian altitude 2 miles.
42	4	
	2	Meridian altitude.

EXAMPLE V.

This is another method. When the altitude at noon is greater than the Greenwich al tude, take half of it, divide the difference between the Greenwich altitude and the Meridi altitude, divide the different times by 4, take the remainder as a correction, as under :

BARBADOES, June 5th, 1864.

	°	′		°	′	
Lat. at Greenwich..	51	28		½)19	21	
	90	00		½) 9	40	
	38	32		½) 4	50	
Declination..... +	22	36		½) 2	25	
	61	8		1	12	....This is the correction required.
	80	29				
	19	21				
	80	29				
	½)61	8				
	30	34				
Correction ..... +	1	12				
	31	46				
Latitude	13	5	Secant....	0114		
Polar Dist.	67	24	Co-Secant	0347		
	112	15				
Half Sum.....	56	7	Sine ..	4·7462		
Difference.....	25	21	Co-Sine	4·6315		
				9·4238		

	h.	m.	s.
	19	59	26
	24	00	00
	4	00	34
Equation..... —		1	46
	3	58	48

= 59·42 Long. West.

EXAMPLE VI.

To find the mean time of Greenwich.

SATURDAY, June 25th, 1864.

Meridian altitude of the Sun was (88·50).

°	′		°	′		
½)88	50	Noon's alt.				
½)44	25		44	25		
			—8	19		
½)22	12					
		Alt.	36	6		
½)11	6	Lat.	22	14	Secant	0335
		P. Dist. .	66	37	Co-Secant	0372
½) 5	33					
			124	57		
½) 2	46	H. Sum.	62	28	Sine	4·6648
8	19	Remain.	26	22	Co-Sine . .	4·6474
		20 4 32				9·3829

	°	′		
Alt. . . .	61	55		
Lat. . .	51	28	Secant	2055
P. Dist.	113	23	Co-Secant .	0372
	226	46		
H. Sum	113	23	Sine	4·5986
Remain.	51	23	Co-Sine . .	4·8933
				9·7346

	h.	m.	s.
	17	40	20
	6	19	40
	24	00	00
	20	4	32
	3	55	28
Equation. .	—	2	21
	3	53	07

The Equation is applied.

58·20 Long. West.

EXAMPLE VII.

WEDNESDAY, June 29th, 1864.

The Greenwich mean time on this day was 24h. 00m. 00s. It is found as in Example I.

RULE.—When south of 30° in North Latitude, the correction is subtracted from the Half-altitude, as laid down.

°	′		°	′		
84	35	Noon's alt.				
	12					
½)84	47					
½)42	23		42	23		
			—7	55		
½)21	11					
			34	28		
½)10	35	Lat. . .	28	26	Secant . .	0558
		P. Dist.	66	47	Co.-Secant	0366
½) 5	17					
			½)129	41		
2	38		64	50	Sine	4·6286
			30	22	Co-Sine .	4·7037
7	55					9·4247

	h.	m.	s.
	19	51	43
Equation. .	+	3	10
	19	54	53
	24	00	00
	4	05	07

61·17 Long. West.

EXAMPLE VIII.

SATURDAY, July 9th, 1864.

This Example is worked by the Ship's Chronometer, to prove the Meridian Altitude.

BY THE CHRONOMETER.

	°	′			
Alt.	32	13			
Lat.	40	10	Secant		1168
P. Dist. .	67	42	Co-Secant .		0337
	140	5			
H. Sum..	70	2	Co-Sine ..		4·5333
Remain .	37	49	Sine		4·7875
	h.	m.	s.		
	19	36	25	=	9·4713
Equation..	+	4	56		
	19	41	21	42	36 West.
	22	31	46		28
	2	50	25	42	19 Differing 17 miles from the Chronometer.

BY THE MERIDIAN ALTITUDE.

	°	′		°	′
½)	11	7		71	57
½)	5	33		60	50 Greenwich alt.
½)	2	46		11	07 difference.
½)	1	23			
	0	41			
	2	4			

	°	′		
½)	71	57		
	35	58		
+	11	07		
	47	5		
+	2	4		
Alt.	49	9		
Lat.	40	21	Secant	1179
P. Dist.	67	42	Co-Secant .	0337
½)	157	12		
H. Sum	78	36	Co-Sine ..	4·2959
Remain.	29	27	Sine	4·6916

	h.	m.	s.		
	21	5	49	=	9·1391
Equation..	+	4	56		
	21	10	45		
	24	00	00		
The ship going to the eastward at the rate of four miles per hour makes the longitude corrected..	2	49	15		42·19 Long. West.

The mean time of Greenwich is found as in other Examples. When north of 45°, caution must be exercised in taking the full altitude at noon.

BY THE CHRONOMETER ON THE SAME DAY IN ANOTHER WAY.

	°	′		
The forenoon's sights being.....	32	13		
This proves the work. Lat.....	40	10	Secant	1168
P. Dist..	67	42	Co-Secant .	0337
	140	5		
H. Sum .	70	2	Co-Sine ..	4·5333
Remain .	37	49	Sine.....	4·7875

	h.	m.	s.		
	19	36	24	=	9·4713
Equation..	+	4	56		
	19	41	20		
	22	31	46		
Mean time of Greenwich by the ship's chronometer	2	50	26		42·36 West. Long.

EXAMPLE VIII—*continued.*

	°	′			
	71	57	Meridian alt.		
	60	50	Greenwich alt.		
	11	7	Difference between the two altitudes.		
			11 7		
			2		
			22 14		½)11 7
	71	57			
	22	14			½) 5 33
	49	43			½) 2 46
	1	1			½) 1 23
Alt.....	48	42			
Lat....	40	21	Secant....	1179	½) 41
P. Dist.	67	42	Co-Secant.	0337	20
½)	156	45			
H. Sum	78	22	Co-Sine ..	4·3045	1 1
Remain.	29	40	Sine.....	4·6945	
	h.	m.	s.		
	21	3	20	= 9·1506	
Equation..	+	4	56		
	21	8	16		
	24	00	00		
	2	51	44		

42·56 West.

Differing 20 miles, at 4 miles per hour, what the ship ran.

EXAMPLE IX.

This Example is to show that the system here laid down can be worked in different ways; and likewise to explain that when north of 45° both East and West, the full altitude is to be taken, and correct by either of the methods which are shown in this Example. If going to the eastward of 45° East, as well as North or South, the full altitude must be worked. If East of 45° or West of 45°, the half altitude is required when corrected.

July 21st, 1864.

	°	′	
	61	32	....Meridian alt.
	58	55	....Greenwich alt.
½)	2	37	....Difference.
½)	1	18	
½)	0	39	
	0	19	
	0	58	....This is the correction to the altitude.

EXAMPLE X.

This Example will show how to find the mean time of Greenwich.

	°	′		
	61	32	Meridian alt.	
Subtract..		58		
Alt.	60	34		
Lat.	48	50	Secant....	1816
P. Dist....	69	37	Co-Secant	0280
½)	179	1		
H. Sum. ..	89	30	Co-Sine	2·9408
Remain. ..	28	56	Sine ..	4·6846

h.	m.	s.		
23	22	18	=	7·8350
24	00	00		
00	37	42		
Equation ..+	6	6		
00	43	48		10·57 Long. West.

	°	′		
	51	28	Latitude of Greenwich.	
	90	00		
	38	32		
	+20	23	Declination North.	
Alt.	58	55		
Lat.	51	28	Secant....	2055
P. Dist...	110	23	Co-Secant	0280
½)	220	46		
H. Sum..	110	23	Co-Sine	4·5419
Remain..	51	28	Sine ..	4·8933

18	15	30	=	9·6687
5	44	30		
24	00	00		Mean time of Greenwich.

The difference of the two altitudes is :

	°	′
½)	2	37
½)	1	18
½)	0	39
	0	19
	0	58 is the correction from which to subtract.

The Meridian altitude is greater than the Greenwich altitude, so the correction is subtracted. When less than the Greenwich altitude, the correction is *added.*

EXAMPLE XI.

To prove the meridian altitude correct.

This Example is worked by the deviation in the altitude. Apply the Deviations as you see the Sines against the Altitude, and you will have the true altitude to find the longitude. The noon's altitude being high, take half.

BARBADOES, June 5th, 1864.

	°	′	
½)	80	29	Noon's alt.
½)	40	14	
+½)	20	7	
½)	10	3	
½)	5	1	
+½)	2	30	
+	1	15	

	°	′
	40	14
	+22	37
	62	51
	+1	15
½)	64	6

Alt.	32	3		
Lat.	13	5	Secant....	0114
P. Dist. ..	67	24	Co-Secant	0347
	112	32		
H. Sum. ..	56	16	Co-Sine	4·7445
Remain. ..	24	13	Sine ..	4·6129

19	58	26	=	9·4036
24	00	00		
4	1	34		
Equation.... —	1	46		
3	59	48		59·57 Long. West.

EXAMPLE XII.

This Example shows how to find the correction north of 45° of latitude.

WEDNESDAY, July 13th, 1864.

	′	″	
	½)66	25	....Noon's alt.
	½)33	12	
+½)	16	36	
	½) 8	18	
	+ 4	9	

	°	′
	33	12
+	20	45
	53	57

In this Example we are in 45° North. It is shown how to find a correction in another way.

°	′	
60	18	..Greenwich altitude.
66	25	..Meridian altitude.
½) 6	7	
½) 3	3	
½) 1	31	
½)	45	
½)	22	
	11	

6	7
	2
12	14
66	25
54	11
—	22
53	49

The Greenwich mean time is found as in 1st Examples.

	°	′		
	33	12		
	+16	36		
	+ 4	9		
Alt.	53	57		
Lat.	45	21	Secant	1513
P. Dist.	68	14	Co-Secant..	0321
	167	32		
H. Sum. ..	83	46	Co-Sine	4·0357
Remain.....	29	49	Sine....	4·6965

	21	46	46	=	8 9156
	24	00	00		
	2	13	14		
Equation....	—	5	28		
	2	7	46	31·56	Long. West.

EXAMPLE XIII.

This Example shows the longitude in another way.

FRIDAY, July 15th, 1864.

	°	′	
	64	34	....Noon's alt.
		12	
	½) 64	46	
	½) 32	23	
	½) 16	11	
	½) 8	5	
+⅓)	4	2	
+	2	1	
	6	3	

	°	′		
	64	46		
	— 16	11		
	48	35		
	+ 6	3		
Alt.	54	38		
Lat.	46	43	Secant ...	1639
P. Dist...	68	32	Co-Secant	0312
	169	53		
H. Sum .	84	56	Co-Sine	4·9460
Remain.	30	18	Sine ..	4·7028

	21	57	36	=	9·8439
Mean time of Greenwich	24	00	00		
	2	2	24		
Equation.....	+	5	40		
	2	8	4	32·1	Long West.

There are different ways of finding the corrections, by which the Altitude is found, but which comes to the same thing in the end. With the distance against 64° in a distant column in the Epitome against 46° of Latitude, take the departure, and divide it as the altitude is divided. Take half, and lay it off. Take the third and last, add them to the half, and you will have the correct Altitude to work.

EXAMPLE XIV.

JANUARY 29th, 1863.

This Example is to prove the meridian altitude.

The question was given at Adelaide Place, London Bridge. The meridian Altitude was 41° 29′ 52″. This is equal to 41° 30′. On this given day the sun's declination was 20° 46′. And the Altitude at Greenwich found by the Latitude 51° 28′, worked back, gives the Altitude 17° 46′, the half of Greenwich Altitude 17° 46′=8° 53′. I find the mean time of Greenwich as laid down in this Example.

Latitude of Greenwich to find the altitude.

	°	′			°	′	
	½)41	30			51	28	
					90	00	
	20	45			38	32	
Cor.....	—2	00			20	46	Declination S.
Alt.	18	45					
Lat	30	16	Secant....	0636	17	46	
P. Dist..	110	46	Co-Secant	0291	41	30	Meridian alt.
	159	47			½)23	44	
H. Sum.	79	53	Co-Sine	4·2446			
Remain..	61	8	Sine ..	4·9423	½)11	57	
	3	26	59 =	9·2796	½) 5	58	
	24	00	00				
	20	33	1		— 2	59	
					17	46	
					14	47	Corrected Greenwich alt.
					51	28	Secant.... 2055
					69	14	Co-Secant 0291
					135	29	
					67	44	Co-Sine 4·5785
					52	57	Sine .. 4·9020

	h.	m.	s.		
	3	48	00	=	9·½)7151
	12	00	00		3575
	8	12	00		
	20	33	1		
	12	21	1		
Equation—	26	44			13 22 Equation.
					2
	11	54	17		26 44

Longitude, 178·34 East; and the given Longitude was 179 East; differing 26 seconds.

EXAMPLE XV.

This is another method of finding the Longitude, which very few take notice of. It is strictly correct, if worked with care, which is shown in this Example.

When North of 45°, take the full altitude at noon, and the difference will be the Longitude. When half the altitude is taken, you will have the Longitude as you see. Take the rising and setting of the sun, which is 24° 11′, being equal to your mean time of Greenwich. No correction is required.

THURSDAY, July 14th, 1864.

	°	′			
	½)65	39	..Meridian alt.		
	32	49			
Lat.	45	58		Secant	1579
P. Dist.....	68	23		Co-Secant..	0316
	½)147	10			
H. Sum.....	73	35		Co-Sine	4·4512
Remain.....	40	46		Sine ..	4·8149

	h.	m.	s.		
	19	41	45	=	9·4556
Equation	+	5	34		
	19	47	19		
	24	11	00		
	½) 4	23	41		
	2	11	50	32·45	Long. West.

EXAMPLE XVI.

In this another Example is given for finding the Longitude by the rising and setting of the Sun. On July 21st, 1864, the Meridian altitude was 61° 32′. The Longitude is found as it is given in other Examples.

	°	′		
	61	32		
	48	59	Secant	1816
	69	37	Co-Secant	0280
	180	8		
	90	4	Co-Sine	2 0657
	28	32	Sine ..	4·6791

There is another way of applying the Equation, as follows:

	h.	m.	s.							
	23	46	29	Apparent time.	23	46	29	=	6·9514	
Half Equation	+	3	3		24	11	00			
	23	49	32		00	24	31			
	24	11	00				2			
	00	21	28			49	2			
			2	Equation ...	—	6	6			
	00	42	56	10·44 Long. West.		42	56		10·44	Long. West.

EXAMPLE XVII.

THURSDAY, July 21st, 1864.

	°	′	
	61	20	Noon's alt.
		12	
½)	61	32	
½)	30	46	
½)	15	23	
½)	7	41	
+ ½)	3	50	
+ ½)	1	55	
+		57	= 30

North of 45° the full altitude can be corrected, as this is :—

°	′
61	32
—	58
60	34

The result is the same as below.

	°	′
	61	32
	—7	41
	53	51
	+3	50
	57	41
	+1	55
	59	36
	+	57

Alt.	60	33		
Lat.	48	50	Secant....	1816
P. Dist. ..	69	37	Co-Secant .	0280
	179	60		
H. Sum. ..	89	30	Co-Sine	2 9408
Remain. ..	28	57	Sine....	4·6848
	23	22	10 =	7·8352
Mean time of Greenwich....	24	00	00	
		37	50	
Equation....+		6	6	
		43	56	10·45 Long. West—diff. 2 miles.

The chronometer showed 10·47.

Against 61·20 in a distant column in the Epitome and Latitude, 48 is 46 in a Departure column. Take four divisions in it as follows:—

½)	46	
½)	23	
½)	11	30
½)	5	45
	2	52

	46	00
+	11	30
+	2	52
	60	22
	+	12
	60	34

The result is the same as above.

This gives the Altitude (60·34) to work the Longitude. It corresponds with the Meridian Altitude.

EXAMPLE XVIII.

TUESDAY, July 5th, 1864.

Being north of 30° of latitude, the correction is a ditive to the half altitude. Mean time of Greenwich is found as it is given in the first Example, for every day.

	°	′						
	78	22	Noon's Alt.					
	+	12						
½)	78	34						
½)	39	17			°	′		
					39	17		
				+	2	27		
½)	19	38						
					41	44		
½)	9	49		Lat....	34	11	Secant....	0823
				P. Dist.	67	15	Co-Secant.	0351
	4	54			143	10		
	2	27		H. Sum	71	35	Sine	4·4995
				Remain.	29	51	Co-Sine ..	4·6969
					h.	m.	s.	
					20	24	5	= 9·3138
				Equation..	+	4	18	
					20	28	23	The ship's chronometer on the same day, 53·00 West.
					24	00	00	
					3	31	37	52·54 Long. West.

There are other methods of finding these corrections by taking the difference between the Greenwich altitude and meridian altitude, and dividing it as it is given in the other Examples.

EXAMPLE XIX.

Being another method of applying the Rule without the application of the Greenwich mean time.

BARBADOES, June 5th, 1643.

RULE.—When south of 23°, or between the tropics (Capricorn and Cancer), take half of the Noon's altitude, the Latitude, and Polar distance; Sum, Half-sum, and Remainder. Then take the Equation of time. Multiply that by 4, and it will be the Correction. Double it again; that will be 9·36 from the Half-noon's altitude, as laid down; apply half the Equation.

	°	′					°	′
½)	80	29	Noon's alt.			Equation..	1	12
								4
	40	14					4	48
Cor.....	9	36						2
Alt.	30	38					9	36
Lat.	13	5		Secant....	0114			
P. Dist..	67	24		Co-Secant.	0347			
½)	111	7						
H. Sum.	55	33		Co-Sine ..	4·7525			
Remain..	24	55		Sine.....	4·6245			
	h.	m.	s.					
	4	7	50	=	9·4231			
		9	36					
	3	58	14					
	+	00	36					
	3	58	50			59·44 Long.		

In this Example, the observer being south of the declination which requires this correction, 9·36 to be subtracted from the altitude, as laid down.

EXAMPLE XX.

THURSDAY, June 30th, 1864.

RULE.—When between the latitude of 23° and 30°, take half the Noon's altitude, 42°, together with the Latitude, Polar distance, Sum, Half-sum, and Difference. You will get the Longitude as laid down in this Example.

	°	′				°	′
H. Noon's alt.	42	23			Equation..	3	10
Lat.	28	26	Secant	0558			4
P. Dist.....	66	47	Co-Secant .	0366		½)12	40
½)137		36				6	20
H. Sum.....	68	48	Co-Sine ..	4·5582			
Remain.....	26	25	Sine	4·6482	Cor. to +	19	00

	h.	m.	s.		
App. T. S...	3	31	55	=	9·2988
	+	19	00		
	3	50	55		
Equation .	+	1	35½		
	3	52	30		58·7 Long.

In this case the Equation is applied as laid down.

EXAMPLE XXI.

SATURDAY, July 9th, 1864.

When north of 30°, or between 30° and 45° north, take half the Noon's altitude and latitude, Polar distance, Sum, Half-sum, and Remainder, as laid down.

	°	′				°	′
H. alt. ..	35	58			Equation..	4	56
Lat.	40	21	Secant....	1179			4
P. dist...	67	42	Co-Secant.	0337		18	24
½)144		1					
H. Sum..	72	00	Co-Sine...	4 4899			
Remain..	36	2	Sine.....	4·7695			

	h.	m.	s.		
	4	4	00	=	9·4110
	+	19	44		
3)	4	23	44		
	1	27	54		
			2		
	2	55	48		
		4	56		
	2	50	52		42·42 Long. West.

In this case the Equation must be applied reverse to the Almanack as laid down.

EXAMPLE XXII.

THURSDAY, July 21st, 1864.

RULE.—When north of 45°, take Latitude, Polar Distance, the Sum, Half-sum, and Remainder. Take the full altitude in this Example, as laid down.

	°	′				°	′	
½)	61	32			Equation.....	6	6	Reverse to the Almanack.
							4	
Alt.	30	46						
Lat.....	48	50	Secant....	1816	For a correction	24	24	
P. Dist..	69	37	Co-Secant.	0280				
	149	13						
H. Sum	74	36	Co-Sine ..	4·4241				
Remain.	43	50	Sine	4·8404				

h.	m.	s.		
4	24	40	=	9·4741
+	24	24		
3)4	49	4		
½)1	36	21		
0	48	10		
	6	6		
	42	4		

10·31 Long. West.

Examples 19, 20, 21, and 22, differ, owing to the deviation in altitudes all round the globe. The learner can use either of the methods laid down in the book, and must pay strict attention to his Rules.

NOTE.

In the Examples 19, 20, 21, and 22, the Equation is multiplied by the daily variation, taken from the following Table for Reducing the Equation of Time. The same Table will work the whole of the Examples in the book.

A TABLE

FOR REDUCING THE EQUATION OF TIME TO ANY TIME UNDER THE MERIDIAN OF GREENWICH.

Greenwich time.	DAILY VARIATION.															
H. M.	1s	2s	4s	6s	8s	10s	12s	14s	16s	18s	20s	22s	24s	26s	28s	30s
	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
0·30	0·0	0·0	0·1	0·1	0·2	0·2	0·3	0·3	0·3	0·4	0·4	0·5	0·5	0·5	0·6	0·6
1·0	0·0	0·1	0·2	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·8	0·9	1·0	1·1	1 2	1·2
1·30	0·1	0·1	0·2	0·4	0·5	0·6	0·8	0·9	1·0	1·1	1·3	1·4	1·5	1·6	1·7	1·8
2·0	0·1	0·2	0·3	0·5	0·7	0·8	1·0	1·2	1·3	1·5	1·7	1·8	2·0	2·2	2·3	2·5
2·30	0·1	0·2	0·4	0·6	0·8	1·0	1·3	1·5	1·7	1·9	2·1	2·3	2·5	2·7	2·9	3·1
3·0	0·1	0·3	0·5	0·7	1·0	1·2	1·5	1·8	2·0	2·2	2·5	2·7	3·0	3·2	3·5	3·7
3·30	0·1	0·3	0·6	0·9	1·2	1·5	1·8	2·0	2·3	2·6	2·9	3·2	3·5	3 7	4·1	4·4
4·0	0·2	0·3	0·7	1·0	1·3	1·7	2·0	2·3	2·6	3·0	3·3	3·7	4·0	4·3	4·7	5·0
4·30	0·2	0·4	0·7	1·1	1·5	1·9	2 3	2·6	3 0	3·4	3·7	4·1	4·5	4·9	5·2	5·6
5·0	0·2	0·4	0·8	1·2	1·7	2·1	2·5	2·9	3·3	3 8	4·2	4·6	5·0	5·4	5·8	6·2
5·30	0·2	0·5	0·9	1·4	1·8	2·3	2·8	3·2	3·7	4·1	4·6	5·0	5·5	5·9	6·4	6·8
6·0	0·2	0·5	1·0	1·5	2·0	2·5	3·0	3·5	4·0	4·5	5·0	5·5	6·0	6·5	7·0	7·5
6·30	0·3	0·5	1·1	1·6	2 2	2·7	3·3	3·8	4·3	4·9	5·4	5·9	6·5	7·0	7·6	8·1
7·0	0·3	0·6	1·2	1·7	2·3	2·9	3·5	4·1	4·7	5·2	5·8	6·4	7·0	7·5	8·1	8·7
7·30	0 3	0·6	1·2	1·9	2·5	3·1	3·8	4·4	5·0	5·6	6 3	6·9	7·5	8·1	8·7	9·4
8·0	0·3	0·7	1·3	2·0	2·7	3 3	4·0	4·7	5·3	6·0	6·7	7·3	8·0	8·6	9·3	10·0
8·30	0·4	0·7	1·4	2·1	2·8	3·5	4·3	5·0	5·7	6·4	7·1	7·8	8·5	9·2	9·9	10·6
9·0	0·4	0·7	1·5	2·2	3·0	3·7	4·5	5·2	6·0	6·8	7·5	8·2	9·0	9·7	10·4	11·2
9 30	0·4	0·8	1·6	2·4	3·2	4·0	4·8	5·5	6·3	7·1	7·9	8·7	9·5	10·2	11·0	11·8
10·0	0·4	0·8	1·7	2·5	3·3	4·2	5 0	5·8	6·7	7·5	8·3	9·2	10·0	10·8	11·6	12·5
10·30	0·4	0·9	1·7	2·6	3·5	4·4	5·3	6·1	7·0	7·9	8·7	9·6	10·5	11·4	12·2	13·1
11·0	0·5	0·9	1·8	2·7	3·7	4·6	5·5	6·4	7·3	8·2	9·2	10·0	11·0	11·9	12·8	13·7
11·30	0·5	1·0	1·9	2·9	3·8	4·8	5·8	6·7	7·7	8 6	9·6	10·5	11·5	12·4	13·4	14·4
12·0	0·5	1·0	2·0	3·0	4·0	5·0	6·0	7·0	8·0	9·0	10·0	11·0	12 0	13·0	14·0	15·0

The following Logarithms will be found to be all that are necessary for working Lucas's system, being TWO FIGURES LESS THAN IN THE EPITOME.

	HALF SUM.										
M.	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	
0	3.241	3.542	3.718	3.843	3.940	4.019	4.085	143	194	239	60
1	234	539	716	841	938	018	084	142	193	238	59
2	227	535	713	839	937	016	083	141	192	238	58
3	219	531	711	838	935	015	082	140	191	237	57
4	211	528	709	836	934	014	081	139	191	236	56
5	3.204	3.524	3.706	3.834	3.933	4.013	4.080	139	190	236	55
6	196	520	704	832	931	011	079	138	189	235	54
7	187	516	701	830	930	010	078	137	188	234	53
8	179	512	699	828	928	009	077	136	187	233	52
9	171	508	696	827	927	008	076	135	187	233	51
10	3.162	3.505	3.694	3.825	3.925	4.007	4.075	134	186	232	50
11	153	501	691	823	924	005	074	133	185	231	49
12	144	497	688	821	922	004	073	132	184	230	48
13	135	493	686	819	921	003	072	131	183	230	47
14	126	488	683	817	919	002	071	130	183	229	46
15	3.116	3.484	3.681	3.815	3.918	4.000	4.070	129	182	228	45
16	107	480	678	813	916	3.999	069	128	181	228	44
17	097	476	675	811	915	998	068	127	180	227	43
18	086	472	673	809	913	997	066	127	179	226	42
19	076	467	670	807	911	995	065	126	178	225	41
20	3.065	3.463	3.667	3.805	3.910	3.994	4.064	125	178	225	40
21	054	459	664	803	908	993	063	124	177	224	39
22	043	454	662	801	907	991	062	123	176	223	38
23	031	450	659	799	905	990	061	122	175	222	37
24	020	445	656	797	904	989	060	121	174	222	36
25	3.007	3.441	3.653	3.795	3.902	3.988	4.059	120	173	221	35
26	2.995	436	651	793	901	986	058	119	173	220	34
27	982	432	648	791	899	985	057	118	172	219	33
28	968	427	645	789	897	984	056	117	171	219	32
29	955	422	642	787	896	982	054	116	170	218	31
30	2.940	3.417	3.639	3.785	3.894	3.981	4.053	115	169	217	30
31	926	413	636	783	893	980	052	114	168	216	29
32	910	408	633	781	891	978	051	113	168	216	28
33	895	403	630	779	889	977	050	112	167	215	27
34	878	398	627	777	888	976	049	111	166	214	26
35	2.861	3.393	3.624	3.775	3.886	3.974	4.048	110	165	213	25
36	843	387	621	773	884	973	047	109	164	213	24
37	825	382	618	770	883	972	046	108	163	212	23
38	806	377	615	768	881	970	044	107	162	211	22
39	785	372	612	766	879	969	043	106	162	210	21
40	2.764	3.366	3.609	3.764	3.878	3.968	4.042	105	161	209	20
41	742	361	606	762	876	966	041	105	160	209	19
42	719	355	603	760	874	965	040	104	159	208	18
43	694	350	600	757	873	964	039	103	158	207	17
44	667	344	597	755	871	962	038	102	157	206	16
45	2.639	3.338	3.593	3.753	3.869	3.961	4.036	101	156	206	15
46	609	332	590	751	868	960	035	100	155	205	14
47	577	327	587	749	866	958	034	099	155	204	13
48	542	321	584	746	864	957	033	098	154	203	12
49	505	314	580	744	863	955	032	097	153	203	11
50	2.463	3.308	3.577	3.742	3.861	3.954	4.031	096	152	202	10
51	417	302	574	739	859	953	029	095	151	201	9
52	366	296	570	737	857	951	028	094	150	200	8
53	308	289	567	735	856	950	027	093	149	199	7
54	241	283	564	733	854	948	026	092	148	199	6
55	2.162	3.276	3.560	3.730	3.852	3.947	4.025	091	148	198	5
56	065	269	557	728	850	946	024	089	147	197	4
57	1.940	263	553	725	848	944	022	088	146	196	3
58	764	256	549	723	847	943	021	087	145	195	2
59	463	249	546	721	845	941	020	086	144	195	1
60	000	241	542	718	843	940	019	085	143	194	0
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	M.
	INDEX+5				DIFFERENCE.					SINES.	

	COSINES.				HALF SUM.						
	°	°	°	°	°	°	°	°	°	°	
M.	79	78	77	76	75	74	73	72	71	70	
0	4.280	317	352	383	413	440	465	489	512	534	60
1	279	317	351	383	412	439	465	489	512	533	59
2	279	316	350	382	412	439	465	489	511	533	58
3	278	316	350	382	411	439	464	488	511	533	57
4	277	315	349	381	411	438	464	488	511	532	56
5	4.277	314	349	381	410	438	463	488	510	532	55
6	276	314	348	380	410	437	463	487	510	531	54
7	276	313	348	380	409	437	463	487	510	531	53
8	275	313	347	379	409	436	462	486	509	531	52
9	274	312	347	379	408	436	462	486	509	530	51
10	4.274	311	346	378	408	435	461	486	508	530	50
11	273	311	346	378	407	435	461	485	508	530	49
12	272	310	345	377	407	435	460	485	508	529	48
13	272	310	344	377	406	434	460	484	507	529	47
14	271	309	344	376	406	434	460	484	507	529	46
15	4.270	308	343	376	405	433	459	484	507	528	45
16	270	308	343	375	405	433	459	483	506	528	44
17	269	307	342	374	404	432	458	483	506	528	43
18	268	307	342	374	404	432	458	482	505	527	42
19	268	306	341	373	403	431	458	482	505	527	41
20	4.267	305	341	373	403	431	457	482	505	527	40
21	266	305	340	372	402	430	457	481	504	526	39
22	266	304	339	372	402	430	456	481	504	526	38
23	265	303	339	371	402	430	456	480	504	525	37
24	264	303	338	371	401	429	455	480	503	525	36
25	4.264	302	338	370	401	429	455	480	503	525	35
26	263	302	337	370	400	428	455	479	502	524	34
27	262	301	337	369	400	428	454	479	502	524	33
28	261	300	336	369	399	427	454	478	502	524	32
29	261	300	335	368	399	427	453	478	501	523	31
30	4.260	299	335	368	398	426	453	478	501	523	30
31	259	299	334	367	398	426	452	477	501	523	29
32	259	298	334	367	397	425	452	477	500	522	28
33	258	297	333	366	397	425	452	476	500	522	27
34	257	297	333	366	396	425	451	476	499	522	26
35	4.257	296	332	365	396	424	451	476	499	521	25
36	256	295	331	365	395	424	450	475	499	521	24
37	255	295	331	364	395	423	450	475	498	520	23
38	255	294	330	363	394	423	449	474	498	520	22
39	254	294	330	363	394	422	449	474	498	520	21
40	4.253	293	329	362	393	422	449	474	497	519	20
41	253	292	329	362	393	421	448	473	497	519	19
42	252	292	328	361	392	421	448	473	496	519	18
43	251	291	327	361	392	420	447	472	496	518	17
44	250	290	327	360	391	420	447	472	496	518	16
45	4.250	290	326	360	391	420	446	472	495	518	15
46	249	289	326	359	390	419	446	471	495	517	14
47	248	288	325	359	390	419	446	471	495	517	13
48	248	288	324	358	389	418	445	470	494	517	12
49	247	287	324	358	389	418	445	470	494	516	11
50	4.246	287	323	357	388	417	444	470	493	516	10
51	246	286	323	356	388	417	444	469	493	515	9
52	245	285	322	356	387	416	443	469	493	515	8
53	244	285	322	355	387	416	443	468	492	515	7
54	243	284	321	355	386	415	442	468	492	514	6
55	4.243	283	320	354	386	415	442	468	491	514	5
56	242	283	320	354	385	414	442	467	491	514	4
57	241	282	319	353	385	414	441	467	491	513	3
58	241	281	319	353	384	413	441	466	490	513	2
59	240	281	318	352	384	413	440	466	490	513	1
60	239	280	317	352	383	413	440	465	489	512	0
	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	M.
	DIFFERENCE.									SINES.	

	COSINES.				HALF SUM.						
M.	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	
0	4.554	573	591	609	625	641	657	671	685	698	60
1	554	573	591	609	625	641	656	671	685	698	59
2	553	572	591	608	625	641	656	671	685	698	58
3	553	572	590	608	625	641	656	670	684	698	57
4	553	572	590	608	624	640	656	670	684	698	56
5	4.552	572	590	607	624	640	655	670	684	697	55
6	552	571	590	607	624	640	655	670	684	697	54
7	552	571	589	607	624	640	655	669	683	697	53
8	551	571	589	607	623	639	655	669	683	697	52
9	551	570	589	606	623	639	654	669	683	696	51
10	4.551	570	588	606	623	639	654	669	683	696	50
11	550	570	588	606	622	638	654	668	683	696	49
12	550	569	588	605	622	638	654	668	682	696	48
13	550	569	587	605	622	638	653	668	682	696	47
14	549	569	587	605	622	638	653	668	682	695	46
15	4.549	568	587	605	621	637	653	668	682	695	45
16	549	568	587	604	621	637	653	667	681	695	44
17	548	568	586	604	621	637	652	667	681	695	43
18	548	567	586	604	621	637	652	667	681	695	42
19	548	567	586	603	620	636	652	667	681	694	41
20	4.547	567	585	603	620	636	652	666	680	694	40
21	547	566	585	603	620	636	651	666	680	694	39
22	547	566	585	603	619	636	651	666	680	694	38
23	546	566	584	602	619	635	651	666	680	693	37
24	546	565	584	602	619	635	651	665	680	693	36
25	4.546	565	584	602	619	635	650	665	679	693	35
26	545	565	584	601	618	635	650	665	679	693	34
27	545	565	583	601	618	634	650	665	679	693	33
28	545	564	583	601	618	634	650	664	679	692	32
29	544	564	583	600	618	634	649	664	678	692	31
30	4.544	564	582	600	617	633	649	664	678	692	30
31	543	563	582	600	617	633	649	664	678	692	29
32	543	563	582	600	617	633	649	663	678	691	28
33	543	563	581	599	616	633	648	663	677	691	27
34	542	562	581	599	616	632	648	663	677	691	26
35	4.542	562	581	599	616	632	648	663	677	691	25
36	542	562	581	598	616	632	648	662	677	691	24
37	541	561	580	598	615	632	647	662	677	690	23
38	541	561	580	598	615	631	647	662	676	690	22
39	541	561	580	598	615	631	647	662	676	690	21
40	4.540	560	579	597	614	631	646	661	676	690	20
41	540	560	579	597	614	631	646	661	676	689	19
42	540	560	579	597	614	630	646	661	675	689	18
43	539	559	578	596	614	630	646	661	675	689	17
44	539	559	578	596	613	630	645	660	675	689	16
45	4.539	559	578	596	613	629	645	660	675	688	15
46	538	558	577	596	613	629	645	660	674	688	14
47	538	558	577	595	612	629	645	660	674	688	13
48	538	558	577	595	612	629	644	660	674	688	12
49	537	557	577	595	612	628	644	659	674	688	11
50	4.537	557	576	594	612	628	644	659	673	687	10
51	537	557	576	594	611	628	644	659	673	687	9
52	536	556	576	594	611	628	643	659	673	687	8
53	536	556	575	593	611	627	643	658	673	687	7
54	536	556	575	593	611	627	643	658	673	686	6
55	4.535	555	575	593	610	627	643	658	672	686	5
56	535	555	574	593	610	627	642	658	672	686	4
57	535	555	574	592	610	626	642	657	672	686	3
58	534	554	574	592	609	626	642	657	672	686	2
59	534	554	573	592	609	626	642	657	671	685	1
60	534	554	573	591	609	625	641	657	671	685	0
	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	M.
	DIFFERENCE.									SINES.	

	COSINES.					HALF SUM.					
M.	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	
0	4.711	724	736	747	758	769	779	789	798	808	60
1	711	724	735	747	758	769	779	789	798	807	59
2	711	723	735	747	758	768	779	789	798	807	58
3	711	723	735	747	758	768	778	788	798	807	57
4	711	723	735	746	757	768	778	788	798	807	56
5	4.710	723	735	746	757	768	778	788	798	807	55
6	710	722	734	746	757	768	778	788	797	807	54
7	710	722	734	746	757	768	778	788	797	807	53
8	710	722	734	746	757	767	778	788	797	806	52
9	709	722	734	745	756	767	777	787	797	806	51
10	4.709	722	734	745	756	767	777	787	797	806	50
11	709	721	733	745	756	767	777	787	797	806	49
12	709	721	733	745	756	767	777	787	796	806	48
13	709	721	733	745	756	766	777	787	796	806	47
14	708	721	733	744	756	766	777	787	796	805	46
15	4.708	721	733	744	755	766	776	786	796	805	45
16	708	720	732	744	755	766	776	786	796	805	44
17	708	720	732	744	755	766	776	786	796	805	43
18	708	720	732	744	755	766	776	786	796	805	42
19	707	720	732	743	755	765	776	786	795	805	41
20	4.707	720	732	743	754	765	776	786	795	805	40
21	707	719	732	743	754	765	775	785	795	804	39
22	707	719	731	743	754	765	775	785	795	804	38
23	706	719	731	743	754	765	775	785	795	804	37
24	706	719	731	743	754	765	775	785	795	804	36
25	4.706	719	731	742	754	764	775	785	794	804	35
26	706	718	731	742	753	764	775	785	794	804	34
27	706	718	730	742	753	764	774	784	794	803	33
28	705	718	730	742	753	764	774	784	794	803	32
29	705	718	730	742	753	764	774	784	794	803	31
30	4.705	718	730	741	753	763	774	784	794	803	30
31	705	717	730	741	752	763	774	784	793	803	29
32	705	717	729	741	752	763	774	784	793	803	28
33	704	717	729	741	752	763	773	783	793	803	27
34	704	717	729	741	752	763	773	783	793	802	26
35	4.704	717	729	740	752	763	773	783	793	802	25
36	704	716	729	740	752	762	773	783	793	802	24
37	703	716	728	740	751	762	773	783	793	802	23
38	703	716	728	740	751	762	773	783	792	802	22
39	703	716	728	740	751	762	772	782	792	802	21
40	4.703	716	728	739	751	762	772	782	792	801	20
41	703	715	728	739	751	762	772	782	792	801	19
42	702	715	727	739	750	761	772	782	792	801	18
43	702	715	727	739	750	761	772	782	792	801	17
44	702	715	727	739	750	761	771	782	791	801	16
45	4.702	714	727	739	750	761	771	781	791	801	15
46	702	714	727	738	750	761	771	781	791	801	14
47	701	714	726	738	749	760	771	781	791	801	13
48	701	714	726	738	749	760	771	781	791	801	12
49	701	714	726	738	749	760	771	781	791	800	11
50	4.701	713	726	738	749	760	770	781	790	800	10
51	700	713	726	737	749	760	770	780	790	800	9
52	700	713	725	737	749	760	770	780	790	800	8
53	700	713	725	737	748	759	770	780	790	799	7
54	700	713	725	737	748	759	770	780	790	799	6
55	4.700	712	725	737	748	759	770	780	790	799	5
56	699	712	725	736	748	759	769	780	789	799	4
57	699	712	724	736	748	759	769	779	789	799	3
58	699	712	724	736	747	758	769	779	789	799	2
59	699	712	724	736	747	758	769	779	789	799	1
60	698	711	724	736	747	758	769	779	789	798	0
	30	31°	32°	33°	34°	35°	36°	37°	38	39°	M.
	DIFFERENCE.									SINES.	

	COSINES.				HALF SUM.						
M.	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	
0	4.816	825	833	841	849	856	864	871	877	884	60
1	816	825	833	841	849	856	864	870	877	884	59
2	816	825	833	841	849	856	863	870	877	884	58
3	816	825	833	841	849	856	863	870	877	883	57
4	816	824	833	841	848	856	863	870	877	883	56
5	4.816	824	833	841	848	856	863	870	877	883	55
6	816	824	832	840	848	856	863	870	877	883	54
7	815	824	832	840	848	856	863	870	877	883	53
8	815	824	832	840	848	855	863	870	876	883	52
9	815	824	832	840	848	855	863	870	876	883	51
10	4.815	824	832	840	848	855	862	869	876	883	50
11	815	823	832	840	848	855	862	869	876	883	49
12	815	823	832	840	847	855	862	869	876	882	48
13	815	823	832	840	847	855	862	869	876	882	47
14	814	823	831	839	847	855	862	869	876	882	46
15	4.814	823	831	839	847	855	862	869	876	882	45
16	814	823	831	839	847	854	862	869	876	882	44
17	814	823	831	839	847	854	862	869	875	882	43
18	814	822	831	839	847	854	862	869	875	882	42
19	814	822	831	839	847	854	861	868	875	882	41
20	4.814	822	831	839	846	854	861	868	875	882	40
21	813	822	830	839	846	854	861	868	875	882	39
22	813	822	830	838	846	854	861	868	875	881	38
23	813	822	830	838	846	854	861	868	875	881	37
24	813	822	830	838	846	853	861	868	875	881	36
25	4.813	821	830	838	846	853	861	868	875	881	35
26	813	821	830	838	846	853	861	868	874	881	34
27	812	821	830	838	846	853	860	867	874	881	33
28	812	821	829	838	845	853	860	867	874	881	32
29	812	821	829	837	845	853	860	867	874	881	31
30	4.812	821	829	837	845	853	860	867	874	881	30
31	812	821	829	837	845	853	860	867	874	880	29
32	812	820	829	837	845	852	860	867	874	880	28
33	812	820	829	837	845	852	860	867	874	880	27
34	811	820	829	837	845	852	860	867	874	880	26
35	4.811	820	828	837	845	852	859	867	873	880	25
36	811	820	828	837	844	852	859	866	873	880	24
37	811	820	828	836	844	852	859	866	873	880	23
38	811	820	828	836	844	852	859	866	873	880	22
39	811	819	828	836	844	852	859	866	873	880	21
40	4.811	819	828	836	844	852	859	866	873	879	20
41	810	819	828	836	844	851	859	866	873	879	19
42	810	819	828	836	844	851	859	866	873	879	18
43	810	819	827	836	843	851	859	866	873	879	17
44	810	819	827	835	843	851	858	866	872	879	16
45	4.810	819	827	835	843	851	858	865	872	879	15
46	810	818	827	835	843	851	858	865	872	879	14
47	810	818	827	835	843	851	858	865	872	879	13
48	809	818	827	835	843	851	858	865	872	879	12
49	809	818	827	835	843	850	858	865	872	878	11
50	4.809	818	826	835	843	850	858	865	872	878	10
51	809	818	826	835	842	850	858	865	872	878	9
52	809	818	826	834	842	850	857	865	871	878	8
53	809	817	826	834	842	850	857	864	871	878	7
54	808	817	826	834	842	850	857	864	871	878	6
55	4.808	817	826	834	842	850	857	864	871	878	5
56	808	817	826	834	842	849	857	864	871	878	4
57	808	817	825	834	842	849	857	864	871	878	3
58	808	817	825	834	842	849	857	864	871	878	2
59	808	817	825	833	841	849	857	864	871	877	1
60	808	816	825	833	841	849	856	864	871	877	0
	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	M.
	DIFFERENCE.									SINES.	

	COSINES.				HALF SUM.						
	°	°	°	°	°	°	°		°	°	
M.	39	38	37	36	35	34	33	32	31	30	
0	4.890	896	902	907	913	918	923	928	933	937	60
1	890	896	902	907	913	918	923	928	932	937	59
2	890	896	902	907	913	918	923	928	932	937	58
3	890	896	902	907	913	918	923	928	932	937	57
4	890	896	901	907	913	918	923	928	932	937	56
5	4.889	896	901	907	912	918	923	928	932	937	55
6	889	895	901	907	912	918	923	927	932	937	54
7	889	895	901	907	912	917	923	927	932	937	53
8	889	895	901	907	912	917	922	927	932	936	52
9	889	895	901	907	912	917	922	927	932	936	51
10	4.889	895	901	907	912	917	922	927	932	936	50
11	889	895	901	906	912	917	922	927	932	936	49
12	889	895	901	906	912	917	922	927	932	936	48
13	889	895	901	906	912	917	922	927	932	936	47
14	889	895	901	906	912	917	922	927	932	936	46
15	4.888	895	900	906	912	917	922	927	931	936	45
16	888	894	900	906	911	917	922	927	931	936	44
17	888	894	900	906	911	917	922	927	931	936	43
18	888	894	900	906	911	917	922	926	931	936	42
19	888	894	900	906	911	916	922	926	931	936	41
20	4.888	894	900	906	911	916	921	926	931	936	40
21	888	894	900	906	911	916	921	926	931	935	39
22	888	894	900	905	911	916	921	926	931	935	38
23	888	894	900	905	911	916	921	926	931	935	37
24	888	894	900	905	911	916	921	926	931	935	36
25	4.887	894	899	905	911	916	921	926	931	935	35
26	887	893	899	905	911	916	921	926	931	935	34
27	887	893	899	905	910	916	921	926	931	935	33
28	887	893	899	905	910	916	921	926	930	935	32
29	887	893	899	905	910	916	921	926	930	935	31
30	4.887	893	899	905	910	915	921	926	930	935	30
31	887	893	899	905	910	915	921	925	930	935	29
32	887	893	899	904	910	915	920	925	930	935	28
33	887	893	899	904	910	915	920	925	930	935	27
34	886	893	899	904	910	915	920	925	930	935	26
35	4.886	893	898	904	910	915	920	925	930	934	25
36	886	892	898	904	910	915	920	925	930	934	24
37	886	892	898	904	910	915	920	925	930	934	23
38	886	892	898	904	909	915	920	925	930	934	22
39	886	892	898	904	909	915	920	925	930	934	21
40	4.886	892	898	904	909	915	920	925	929	934	20
41	886	892	898	904	909	915	920	925	929	934	19
42	886	892	898	904	909	914	920	925	929	934	18
43	886	892	898	903	909	914	920	924	929	934	17
44	885	892	898	903	909	914	919	924	929	934	16
45	4.885	892	898	903	909	914	919	924	929	934	15
46	885	891	897	903	909	914	919	924	929	934	14
47	885	891	897	903	909	914	919	924	929	934	13
48	885	891	897	903	909	914	919	924	929	933	12
49	885	891	897	903	908	914	919	924	929	933	11
50	4.885	891	897	903	908	914	919	924	929	933	10
51	885	891	897	903	908	914	919	924	929	933	9
52	885	891	897	903	908	914	919	924	929	933	8
53	884	891	897	903	908	913	919	924	928	933	7
54	884	891	897	902	908	913	919	924	928	933	6
55	4.884	891	897	902	908	913	919	924	928	933	5
56	884	890	896	902	908	913	918	923	928	933	4
57	884	890	896	902	908	913	918	923	928	933	3
58	884	890	896	902	908	913	918	923	928	933	2
59	884	890	896	902	908	913	918	923	928	933	1
60	884	890	896	902	907	913	918	923	928	933	0
	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	M.
	DIFFERENCE.									SINES.	

	COSINES.				HALF SUM.						
M.	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	
0	4.941	945	949	953	957	960	964	967	970	972	60
1	941	945	949	953	957	960	963	967	970	972	59
2	941	945	949	953	957	960	963	967	970	972	58
3	941	945	949	953	957	960	963	967	970	972	57
4	941	945	949	953	957	960	963	966	969	972	56
5	4.941	945	949	953	956	960	963	966	969	972	55
6	941	945	949	953	956	960	963	966	969	972	54
7	941	945	949	953	956	960	963	966	969	972	53
8	941	945	949	953	956	960	963	966	969	972	52
9	941	945	949	953	956	960	963	966	969	972	51
10	4.941	945	949	953	956	960	963	966	969	972	50
11	941	945	949	952	956	960	963	966	969	972	49
12	940	945	949	952	956	960	963	966	969	972	48
13	940	945	949	952	956	960	963	966	969	972	47
14	940	944	948	952	956	959	963	966	969	972	46
15	4.940	944	948	952	956	959	963	966	969	972	45
16	940	944	948	952	956	959	963	966	969	972	44
17	940	944	948	952	956	959	963	966	969	972	43
18	940	944	948	952	956	959	963	966	969	972	42
19	940	944	948	952	956	959	963	966	969	972	41
20	4.940	944	948	952	956	959	962	966	969	972	40
21	940	944	948	952	956	959	962	966	969	972	39
22	940	944	948	952	955	959	962	966	969	971	38
23	940	944	948	952	955	959	962	965	969	971	37
24	940	944	948	952	955	959	962	965	968	971	36
25	4.940	944	948	952	955	959	962	965	968	971	35
26	939	944	948	952	955	959	962	965	968	971	34
27	939	944	948	951	955	959	962	965	968	971	33
28	939	944	948	951	955	959	962	965	968	971	32
29	939	943	947	951	955	959	962	965	968	971	31
30	4.939	943	947	951	955	959	962	965	968	971	30
31	939	943	947	951	955	958	962	965	968	971	29
32	939	943	947	951	955	958	962	965	968	971	28
33	939	943	947	951	955	958	962	965	968	971	27
34	939	943	947	951	955	958	962	965	968	971	26
35	4.939	943	947	951	955	958	962	965	968	971	25
36	939	943	947	951	955	958	962	965	968	971	24
37	939	943	947	951	955	958	962	965	968	971	23
38	939	943	947	951	955	958	961	965	968	971	22
39	939	943	947	951	954	958	961	965	968	971	21
40	4.938	943	947	951	954	958	961	965	968	971	20
41	938	943	947	951	954	958	961	965	968	971	19
42	938	943	947	951	954	958	961	964	968	971	18
43	938	943	947	950	954	958	961	964	968	970	17
44	938	942	947	950	954	958	961	964	967	970	16
45	4.938	942	946	950	954	958	961	964	967	970	15
46	938	942	946	950	954	958	961	964	967	970	14
47	938	942	946	950	954	958	961	964	967	970	13
48	938	942	946	950	954	957	961	964	967	970	12
49	938	942	946	950	954	957	961	964	967	970	11
50	4.938	942	946	950	954	957	961	964	967	970	10
51	938	942	946	950	954	957	961	964	967	970	9
52	938	942	946	950	954	957	961	964	967	970	8
53	938	942	946	950	954	957	961	964	967	970	7
54	937	942	946	950	954	957	961	964	967	970	6
55	4.937	942	946	950	953	957	961	964	967	970	5
56	937	942	946	950	953	957	960	964	967	970	4
57	937	942	946	950	953	957	960	964	967	970	3
58	937	941	946	950	953	957	960	964	967	970	2
59	937	941	946	949	953	957	960	964	967	970	1
60	937	941	945	949	953	957	960	964	967	970	0
	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	M.
	DIFFERENCE.									SINES.	

	COSINES.				HALF SUM.						
M.	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	
0	4.975	978	980	982	984	986	988	990	991	993	60
1	975	978	980	982	984	986	988	990	991	993	59
2	975	978	980	982	984	986	988	990	991	993	58
3	975	978	980	982	984	986	988	990	991	993	57
4	975	978	980	982	984	986	988	990	991	993	56
5	4.975	978	980	982	984	986	988	990	991	993	55
6	975	977	980	982	984	986	988	990	991	993	54
7	975	977	980	982	984	986	988	990	991	993	53
8	975	977	980	982	984	986	988	990	991	993	52
9	975	977	980	982	984	986	988	990	991	993	51
10	4.975	977	980	982	984	986	988	990	991	993	50
11	975	977	980	982	984	986	988	990	991	993	49
12	975	977	980	982	984	986	988	990	991	993	48
13	975	977	980	982	984	986	988	990	991	993	47
14	975	977	980	982	984	986	988	990	991	993	46
15	4.975	977	980	982	984	986	988	990	991	993	45
16	974	977	979	982	984	986	988	989	991	992	44
17	974	977	979	982	984	986	988	989	991	992	43
18	974	977	979	982	984	986	988	989	991	992	42
19	974	977	979	982	984	986	988	989	991	992	41
20	4.974	977	979	982	984	986	988	989	991	992	40
21	974	977	979	982	984	986	988	989	991	992	39
22	974	977	979	982	984	986	988	989	991	992	38
23	974	977	979	982	984	986	988	989	991	992	37
24	974	977	979	981	984	986	988	989	991	992	36
25	4.974	977	979	981	984	986	987	989	991	992	35
26	974	977	979	981	984	986	987	989	991	992	34
27	974	977	979	981	984	986	987	989	991	992	33
28	974	977	979	981	983	986	987	989	991	992	32
29	974	977	979	981	983	985	987	989	991	992	31
30	4.974	976	979	981	983	985	987	989	991	992	30
31	974	976	979	981	983	985	987	989	991	992	29
32	974	976	979	981	983	985	987	989	991	992	28
33	974	976	979	981	983	985	987	989	991	992	27
34	974	976	979	981	983	985	987	989	991	992	26
35	4.974	976	979	981	983	985	987	989	991	992	25
36	974	976	979	981	983	985	987	989	991	992	24
37	974	976	979	981	983	985	987	989	991	992	23
38	973	976	979	981	983	985	987	989	990	992	22
39	973	976	979	981	983	985	987	989	990	992	21
40	4.973	976	979	981	983	985	987	989	990	992	20
41	973	976	978	981	983	985	987	989	990	992	19
42	973	976	978	981	983	985	987	989	990	992	18
43	973	976	978	981	983	985	987	989	990	992	17
44	973	976	978	981	983	985	987	989	990	992	16
45	4.973	976	978	981	983	985	987	989	990	992	15
46	973	976	978	981	983	985	987	989	990	992	14
47	973	976	978	981	983	985	987	989	990	992	13
48	973	976	978	981	983	985	987	989	990	992	12
49	973	976	978	981	983	985	987	989	990	992	11
50	4.973	976	978	980	983	985	987	989	990	992	10
51	973	976	978	980	983	985	987	988	990	992	9
52	973	976	978	980	983	985	987	988	990	992	8
53	973	975	978	980	983	985	987	988	990	992	7
54	973	975	978	980	983	985	987	988	990	992	6
55	4.973	975	978	980	983	985	987	988	990	992	5
56	973	975	978	980	982	985	987	988	990	992	4
57	973	975	978	980	982	985	987	988	990	992	3
58	973	975	978	980	982	985	986	988	990	992	2
59	973	975	978	980	982	984	986	988	990	991	1
60	972	975	978	980	982	984	986	988	990	991	0
	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	M.
	DIFFERENCE.									SINES.	

	COSINES.				HALF SUM.						
M.	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	
0	4.994	995	996	997	998	998	999	999	999	000	60
1	994	995	996	997	998	998	999	999	999	000	59
2	994	995	996	997	998	998	999	999	999	000	58
3	994	995	996	997	998	998	999	999	999	000	57
4	994	995	996	997	998	998	999	999	999	000	56
5	4.994	995	996	997	998	998	999	999	999	000	55
6	994	995	996	997	998	998	999	999	999	000	54
7	994	995	996	997	998	998	999	999	999	000	53
8	994	995	996	997	998	998	999	999	999	000	52
9	994	995	996	997	998	998	999	999	999	000	51
10	4.994	995	996	997	998	998	999	999	999	000	50
11	994	995	996	997	998	998	999	999	999	000	49
12	994	995	996	997	998	998	999	999	999	000	48
13	994	995	996	997	998	998	999	999	999	000	47
14	994	995	996	997	998	998	999	999	999	000	46
15	4.994	995	996	997	998	998	999	999	999	000	45
16	994	995	996	997	998	998	999	999	999	000	44
17	994	995	996	997	998	998	999	999	999	999	43
18	994	995	996	997	998	998	999	999	999	999	42
19	994	995	996	997	998	998	999	999	999	999	41
20	4.994	995	996	997	998	998	999	999	999	999	40
21	994	995	996	997	998	998	999	999	999	999	39
22	994	995	996	997	998	998	999	999	999	999	38
23	994	995	996	997	998	998	999	999	999	999	37
24	994	995	996	997	998	998	999	999	999	999	36
25	4.994	995	996	997	998	998	999	999	999	999	35
26	994	995	996	997	998	998	999	999	999	999	34
27	994	995	996	997	998	998	999	999	999	999	33
28	994	995	996	997	998	998	999	999	999	999	32
29	994	995	996	997	998	998	999	999	999	999	31
30	4.994	995	996	997	998	998	999	999	999	999	30
31	993	995	996	997	997	998	999	999	999	999	29
32	993	995	996	997	997	998	999	999	999	999	28
33	993	995	996	997	997	998	999	999	999	999	27
34	993	995	996	997	997	998	999	999	999	999	26
35	4.993	995	996	997	997	998	999	999	999	999	25
36	993	995	996	997	997	998	999	999	999	999	24
37	993	995	996	997	997	998	999	999	999	999	23
38	993	995	996	997	997	998	999	999	999	999	22
39	993	995	996	997	997	998	999	999	999	999	21
40	4.993	995	996	997	997	998	999	999	999	999	20
41	993	994	996	997	997	998	999	999	999	999	19
42	993	994	996	997	997	998	999	999	999	999	18
43	993	994	996	997	997	998	999	999	999	999	17
44	993	994	996	996	997	998	999	999	999	999	16
45	4.993	994	996	996	997	998	999	999	999	999	15
46	993	994	996	996	997	998	999	999	999	999	14
47	993	994	995	996	997	998	999	999	999	999	13
48	993	994	995	996	997	998	999	999	999	999	12
49	993	994	995	996	997	998	999	999	999	999	11
50	4.993	994	995	996	997	998	999	999	999	999	10
51	993	994	995	996	997	998	999	999	999	999	9
52	993	994	995	996	997	998	999	999	999	999	8
53	993	994	995	996	997	998	999	999	999	999	7
54	993	994	995	996	997	998	998	999	999	999	6
55	4.993	994	995	996	997	998	998	999	999	999	5
56	993	994	995	996	997	998	998	999	999	999	4
57	993	994	995	996	997	998	998	999	999	999	3
58	993	994	995	996	997	998	998	999	999	999	2
59	993	994	995	996	997	998	998	999	999	999	1
60	993	994	995	996	997	998	998	999	999	999	0
	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	M.
	DIFFERENCE.								SINES.		

	SECANTS.				LATITUDE, OR POLAR DISTANCE.						
M.	0 or 90	1 . 91	2 . 92	3 . 93	4 . 94	5 . 95	6 . 96	7 . 97	8 . 98	9 . 99	
0	0.000	000	000	000	001	001	002	003	004	005	60
1	000	000	000	000	001	001	002	003	004	005	59
2	000	000	000	000	001	001	002	003	004	005	58
3	000	000	000	000	001	001	002	003	004	005	57
4	000	000	000	000	001	001	002	003	004	005	56
5	0.000	000	000	000	001	001	002	003	004	005	55
6	000	000	000	000	001	001	002	003	004	005	54
7	000	000	000	000	001	001	002	003	004	005	53
8	000	000	000	000	001	001	002	003	004	005	52
9	000	000	000	000	001	001	002	003	004	005	51
10	0.000	000	000	000	001	001	002	003	004	005	50
11	000	000	000	000	001	001	002	003	004	005	49
12	000	000	000	000	001	001	002	003	004	005	48
13	000	000	000	000	001	001	002	003	004	005	47
14	000	000	000	000	001	001	002	003	004	005	46
15	0.000	000	000	000	001	001	002	003	004	005	45
16	000	000	000	000	001	001	002	003	004	005	44
17	000	000	000	000	001	001	002	003	004	005	43
18	000	000	000	000	001	001	002	003	004	005	42
19	000	000	000	000	001	001	002	003	004	005	41
20	0.000	000	000	000	001	001	002	003	004	005	40
21	000	000	000	000	001	001	002	003	004	005	39
22	000	000	000	000	001	001	002	003	004	005	38
23	000	000	000	000	001	001	002	003	004	005	37
24	000	000	000	000	001	001	002	003	004	005	36
25	0.000	000	000	000	001	001	002	003	004	005	35
26	000	000	000	000	001	001	002	003	004	005	34
27	000	000	000	000	001	001	002	003	004	005	33
28	000	000	000	000	001	001	002	003	004	005	32
29	000	000	000	000	001	001	002	003	004	005	31
30	0.000	000	000	000	001	002	002	003	004	006	30
31	000	000	000	000	001	002	002	003	004	006	29
32	000	000	000	000	001	002	002	003	004	006	28
33	000	000	000	000	001	002	002	003	004	006	27
34	000	000	000	000	001	002	002	003	004	006	26
35	0.000	000	000	000	001	002	002	003	004	006	25
36	000	000	000	000	001	002	002	003	004	006	24
37	000	000	000	000	001	002	002	003	004	006	23
38	000	000	000	000	001	002	002	003	004	006	22
39	000	000	000	000	001	002	002	003	004	006	21
40	0.000	000	000	000	001	002	002	003	004	006	20
41	000	000	000	000	001	002	002	003	005	006	19
42	000	000	000	000	001	002	002	003	005	006	18
43	000	000	000	000	001	002	002	003	005	006	17
44	000	000	000	000	001	002	003	003	005	006	16
45	0.000	000	000	000	001	002	003	003	005	006	15
46	000	000	000	000	001	002	003	004	005	006	14
47	000	000	000	000	001	002	003	004	005	006	13
48	000	000	000	000	001	002	003	004	005	006	12
49	000	000	000	000	001	002	003	004	005	006	11
50	0.000	000	000	000	001	002	003	004	005	006	10
51	000	000	000	000	001	002	003	004	005	006	9
52	000	000	000	000	001	002	003	004	005	006	8
53	000	000	000	001	001	002	003	004	005	006	7
54	000	000	000	001	001	002	003	004	005	006	6
55	0.000	000	000	001	001	002	003	004	005	006	5
56	000	000	000	001	001	002	003	004	005	006	4
57	000	000	000	001	001	002	003	004	005	006	3
58	000	000	000	001	001	002	003	004	005	006	2
59	000	000	000	001	001	002	003	004	005	006	1
60	000	000	000	001	001	002	003	004	005	006	0
	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	M.
	POLAR DISTANCE.							COSECANTS.			

	SECANTS.				LATITUDE, OR POLAR DISTANCE.						
M.	10°.100	11°.101	12°.102	13°.103	14°.104	15°.105	16°.106	17°.107	18°.108	19°.109	
0	0·006	008	009	011	013	015	017	019	021	024	60
1	006	008	009	011	013	015	017	019	021	024	59
2	006	008	009	011	013	015	017	019	021	024	58
3	006	008	009	011	013	015	017	019	021	024	57
4	006	008	009	011	013	015	017	019	021	024	56
5	0·006	008	009	011	013	015	017	019	022	024	55
6	006	008	009	011	013	015	017	019	022	024	54
7	006	008	009	011	013	015	017	019	022	024	53
8	006	008	009	011	013	015	017	019	022	024	52
9	006	008	009	011	013	015	017	019	022	024	51
10	0·006	008	009	011	013	015	017	019	022	024	50
11	006	008	009	011	013	015	017	019	022	024	49
12	006	008	009	011	013	015	017	019	022	024	48
13	006	008	009	011	013	015	017	019	022	024	47
14	006	008	009	011	013	015	017	019	022	024	46
15	0·006	008	010	011	013	015	017	019	022	024	45
16	007	008	010	011	013	015	017	020	022	025	44
17	007	008	010	011	013	015	017	020	022	025	43
18	007	008	010	011	013	015	017	020	022	025	42
19	007	008	010	011	013	015	017	020	022	025	41
20	0·007	008	010	011	013	015	017	020	022	025	40
21	007	008	010	011	013	015	017	020	022	025	39
22	007	008	010	011	013	015	017	020	022	025	38
23	007	008	010	011	013	015	018	020	022	025	37
24	007	008	010	011	013	015	018	020	022	025	36
25	0·007	008	010	012	013	015	018	020	022	025	35
26	007	008	010	012	013	015	018	020	022	025	34
27	007	008	010	012	013	015	018	020	022	025	33
28	007	008	010	012	013	016	018	020	022	025	32
29	007	008	010	012	014	016	018	020	023	025	31
30	0·007	008	010	012	014	016	018	020	023	025	30
31	007	008	010	012	014	016	018	020	023	025	29
32	007	008	010	012	014	016	018	020	023	025	28
33	007	008	010	012	014	016	018	020	023	025	27
34	007	008	010	012	014	016	018	020	023	025	26
35	0·007	008	010	012	014	016	018	020	023	025	25
36	007	008	010	012	014	016	018	020	023	025	24
37	007	008	010	012	014	016	018	020	023	025	23
38	007	009	010	012	014	016	018	020	023	026	22
39	007	009	010	012	014	016	018	020	023	026	21
40	0·007	009	010	012	014	016	018	020	023	026	20
41	007	009	010	012	014	016	018	021	023	026	19
42	007	009	010	012	014	016	018	021	023	026	18
43	007	009	010	012	014	016	018	021	023	026	17
44	007	009	010	012	014	016	018	021	023	026	16
45	0·007	009	010	012	014	016	018	021	023	026	15
46	007	009	010	012	014	016	018	021	023	026	14
47	007	009	010	012	014	016	018	021	023	026	13
48	007	009	010	012	014	016	018	021	023	026	12
49	007	009	010	012	014	016	018	021	023	026	11
50	0·007	009	010	012	014	016	019	021	023	026	10
51	007	009	011	012	014	016	019	021	023	026	9
52	007	009	011	012	014	016	019	021	023	026	8
53	007	009	011	012	014	016	019	021	024	026	7
54	007	009	011	012	014	016	019	021	024	026	6
55	0·007	009	011	012	014	016	019	021	024	026	5
56	007	009	011	012	014	017	019	021	024	026	4
57	007	009	011	013	014	017	019	021	024	026	3
58	008	009	011	013	014	017	019	021	024	026	2
59	008	009	011	013	015	017	019	021	024	026	1
60	008	009	011	013	015	017	019	021	024	027	0
	79°	78°	77°	76°	75°	74°	73	72°	71	70°	M.
	POLAR DISTANCE.								COSECANTS.		

	SECANTS.				LATITUDE, OR POLAR DISTANCE.						
M.	20 or 110	21.111	22.112	23.113	24.114	25.115	26.116	27.117	28.118	29.119	
0	0.027	029	032	035	039	042	046	050	054	058	60
1	027	029	032	036	039	042	046	050	054	058	59
2	027	029	032	036	039	042	046	050	054	058	58
3	027	029	032	036	039	042	046	050	054	058	57
4	027	030	033	036	039	042	046	050	054	058	56
5	0.027	030	033	036	039	043	046	050	054	058	55
6	027	030	033	036	039	043	046	050	054	058	54
7	027	030	033	036	039	043	046	050	054	058	53
8	027	030	033	036	039	043	046	050	054	058	52
9	027	030	033	036	039	043	046	050	054	058	51
10	0.027	030	033	036	039	043	046	050	054	058	50
11	027	030	033	036	039	043	047	050	054	058	49
12	027	030	033	036	039	043	047	050	054	059	48
13	027	030	033	036	040	043	047	050	054	059	47
14	027	030	033	036	040	043	047	051	055	059	46
15	0.027	030	033	036	040	043	047	051	055	059	45
16	027	030	033	036	040	043	047	051	055	059	44
17	027	030	033	036	040	043	047	051	055	059	43
18	027	030	033	036	040	043	047	051	055	059	42
19	027	030	033	037	040	043	047	051	055	059	41
20	0.027	030	033	037	040	043	047	051	055	059	40
21	027	030	033	037	040	043	047	051	055	059	39
22	028	030	033	037	040	044	047	051	055	059	38
23	028	030	034	037	040	044	047	051	055	059	37
24	028	031	034	037	040	044	047	051	055	059	36
25	0.028	031	034	037	040	044	047	051	055	059	35
26	028	031	034	037	040	044	047	051	055	060	34
27	028	031	034	037	040	044	048	051	055	060	33
28	028	031	034	037	040	044	048	051	055	060	32
29	028	031	034	037	040	044	048	052	056	060	31
30	0.028	031	034	037	040	044	048	052	056	060	30
31	028	031	034	037	041	044	048	052	056	060	29
32	028	031	034	037	041	044	048	052	056	060	28
33	028	031	034	037	041	044	048	052	056	060	27
34	028	031	034	037	041	044	048	052	056	060	26
35	0.028	031	034	037	041	044	048	052	056	060	25
36	028	031	034	037	041	044	048	052	056	060	24
37	028	031	034	037	041	044	048	052	056	060	23
38	028	031	034	038	041	045	048	052	056	060	22
39	028	031	034	038	041	045	048	052	056	060	21
40	0.028	031	034	038	041	045	048	052	056	061	20
41	028	031	034	038	041	045	048	052	056	061	19
42	028	031	035	038	041	045	048	052	056	061	18
43	029	031	035	038	041	045	049	052	057	061	17
44	029	032	035	038	041	045	049	053	057	061	16
45	0.029	032	035	038	041	045	049	053	057	061	15
46	029	032	035	038	041	045	049	053	057	061	14
47	029	032	035	038	041	045	049	053	057	061	13
48	029	032	035	038	042	045	049	053	057	061	12
49	029	032	035	038	042	045	049	053	057	061	11
50	0.029	032	035	038	042	045	049	053	057	061	10
51	029	032	035	038	042	045	049	053	057	061	9
52	029	032	035	038	042	045	049	053	057	061	8
53	029	032	035	038	042	045	049	053	057	061	7
54	029	032	035	038	042	045	049	053	057	062	6
55	0.029	032	035	038	042	046	049	053	057	062	5
56	029	032	035	039	042	046	049	053	057	062	4
57	029	032	035	039	042	046	049	053	057	062	3
58	029	032	035	039	042	046	049	053	058	062	2
59	029	032	035	039	042	046	050	054	058	062	1
60	029	032	035	039	042	046	050	054	058	062	0
	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	M.
	POLAR DISTANCE.								COSECANTS.		

	SECANTS.				LATITUDE, OR POLAR DISTANCE.						
M.	30 or 120	31.121	32.122	33.123	34.124	35.125	36.126	37.127	38.128	39.129	
0	0.062	066	071	076	081	086	092	097	103	109	60
1	062	067	071	076	081	086	092	097	103	109	59
2	062	067	071	076	081	086	092	097	103	109	58
3	062	067	071	076	081	086	092	097	103	109	57
4	062	067	071	076	081	086	092	098	103	109	56
5	0.062	067	071	076	081	087	092	098	103	110	55
6	062	067	072	076	081	087	092	098	104	110	54
7	062	067	072	076	082	087	092	098	104	110	53
8	063	067	072	077	082	087	092	098	104	110	52
9	063	067	072	077	082	087	092	098	104	110	51
10	0.063	067	072	077	082	087	092	098	104	110	50
11	063	067	072	077	082	087	093	098	104	110	49
12	063	067	072	077	082	087	093	098	104	110	48
13	063	067	072	077	082	087	093	098	104	110	47
14	063	068	072	077	082	087	093	098	104	110	46
15	0.063	068	072	077	082	087	093	099	104	111	45
16	063	068	072	077	082	088	093	099	105	111	44
17	063	068	072	077	082	088	093	099	105	111	43
18	063	068	073	077	082	088	093	099	105	111	42
19	063	068	073	077	083	088	093	099	105	111	41
20	0.063	068	073	078	083	088	093	099	105	111	40
21	064	068	073	078	083	088	093	099	105	111	39
22	064	068	073	078	083	088	094	099	105	111	38
23	064	068	073	078	083	088	094	099	105	111	37
24	064	068	073	078	083	088	094	099	105	111	36
25	0.064	068	073	078	083	088	094	100	105	112	35
26	064	068	073	078	083	088	094	100	106	112	34
27	064	069	073	078	083	089	094	100	106	112	33
28	064	069	073	078	083	089	094	100	106	112	32
29	064	069	073	078	083	089	094	100	106	112	31
30	0.064	069	073	078	084	089	094	100	106	112	30
31	064	069	074	078	084	089	094	100	106	112	29
32	064	069	074	079	084	089	095	100	106	112	28
33	064	069	074	079	084	089	095	100	106	112	27
34	064	069	074	079	084	089	095	100	106	113	26
35	0.065	069	074	079	084	089	095	101	106	113	25
36	065	069	074	079	084	089	095	101	107	113	24
37	065	069	074	079	084	089	095	101	107	113	23
38	065	069	074	079	084	090	095	101	107	113	22
39	065	069	074	079	084	090	095	101	107	113	21
40	0.065	070	074	079	084	090	095	101	107	113	20
41	065	070	074	079	084	090	095	101	107	113	19
42	065	070	074	079	085	090	095	101	107	113	18
43	065	070	075	079	085	090	096	101	107	113	17
44	065	070	075	080	085	090	096	101	107	114	16
45	0.065	070	075	080	085	090	096	101	107	114	15
46	065	070	075	080	085	090	096	102	108	114	14
47	065	070	075	080	085	090	096	102	108	114	13
48	066	070	075	080	085	090	096	102	108	114	12
49	066	070	075	080	085	091	096	102	108	114	11
50	0.066	070	075	080	085	091	096	102	108	114	10
51	066	070	075	080	085	091	096	102	108	114	9
52	066	070	075	080	085	091	096	102	108	114	8
53	066	071	075	080	086	091	096	102	108	115	7
54	066	071	075	080	086	091	097	102	108	115	6
55	0.066	071	076	081	086	091	097	102	108	115	5
56	066	071	076	081	086	091	097	103	109	115	4
57	066	071	076	081	086	091	097	103	109	115	3
58	066	071	076	081	086	091	097	103	109	115	2
59	066	071	076	081	086	091	097	103	109	115	1
60	066	071	076	081	086	092	097	103	109	115	0
	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	M.
	POLAR DISTANCE.								COS. CANTS.		

	SECANTS.				LATITUDE, OR POLAR DISTANCE.						
M.	40°130	41°131	42°132	43°133	44°134	45°135	46°136	47°137	48°138	49°139	
0	0.115	122	128	135	143	150	158	166	174	183	60
1	115	122	129	135	143	150	158	166	174	183	59
2	115	122	129	136	143	150	158	166	174	183	58
3	116	122	129	136	143	150	158	166	174	183	57
4	116	122	129	136	143	151	158	166	175	183	56
5	0.116	122	129	136	143	151	158	166	175	183	55
6	116	122	129	136	143	151	159	167	175	183	54
7	116	122	129	136	143	151	159	167	175	184	53
8	116	123	129	136	144	151	159	167	175	184	52
9	116	123	129	136	144	151	159	167	175	184	51
10	0.116	123	130	137	144	151	159	167	175	184	50
11	116	123	130	137	144	151	159	167	176	184	49
12	117	123	130	137	144	152	159	167	176	184	48
13	117	123	130	137	144	152	159	167	176	184	47
14	117	123	130	137	144	152	160	168	176	185	46
15	0.117	123	130	137	144	152	160	168	176	185	45
16	117	123	130	137	145	152	160	168	176	185	44
17	117	124	130	137	145	152	160	168	176	185	43
18	117	124	130	138	145	152	160	168	177	185	42
19	117	124	131	138	145	152	160	168	177	185	41
20	0.117	124	131	138	145	153	160	168	177	185	40
21	117	124	131	138	145	153	160	169	177	186	39
22	118	124	131	138	145	153	161	169	177	186	38
23	118	124	131	138	145	153	161	169	177	186	37
24	118	124	131	138	146	153	161	169	177	186	36
25	0.118	124	131	138	146	153	161	169	178	186	35
26	118	125	131	138	146	153	161	169	178	186	34
27	118	125	132	139	146	153	161	169	178	187	33
28	118	125	132	139	146	154	161	170	178	187	32
29	118	125	132	139	146	154	162	170	178	187	31
30	0.118	125	132	139	146	154	162	170	178	187	30
31	119	125	132	139	146	154	162	170	178	187	29
32	119	125	132	139	147	154	162	170	179	187	28
33	119	125	132	139	147	154	162	170	179	187	27
34	119	125	132	139	147	154	162	170	179	188	26
35	0.119	126	132	140	147	154	162	171	179	188	25
36	119	126	133	140	147	155	162	171	179	188	24
37	119	126	133	140	147	155	163	171	179	188	23
38	119	126	133	140	147	155	163	171	179	188	22
39	119	126	133	140	147	155	163	171	180	188	21
40	0.119	126	133	140	148	155	163	171	180	188	20
41	120	126	133	140	148	155	163	171	180	189	19
42	120	126	133	140	148	155	163	171	180	189	18
43	120	127	133	141	148	156	163	172	180	189	17
44	120	127	134	141	148	156	164	172	180	189	16
45	0.120	127	134	141	148	156	164	172	180	189	15
46	120	127	134	141	148	156	164	172	181	189	14
47	120	127	134	141	148	156	164	172	181	189	13
48	120	127	134	141	149	156	164	172	181	190	12
49	121	127	134	141	149	156	164	172	181	190	11
50	0.121	127	134	141	149	156	164	173	181	190	10
51	121	127	134	141	149	157	165	173	181	190	9
52	121	128	134	142	149	157	165	173	181	190	8
53	121	128	135	142	149	157	165	173	182	190	7
54	121	128	135	142	149	157	165	173	182	191	6
55	0.121	128	135	142	149	157	165	173	182	191	5
56	121	128	135	142	150	157	165	173	182	191	4
57	121	128	135	142	150	157	165	174	182	191	3
58	122	128	135	142	150	157	165	174	182	191	2
59	122	128	135	142	150	158	166	174	182	191	1
60	122	128	135	143	150	158	166	174	183	191	0
	49°	48°	47°	46°	45°	44°	43°	42°	41°	40	M.
	POLAR DISTANCE.								COSECANTS.		

	SECANTS.				LATITUDE.						
M.	° 50	° 51	° 52	° 53	° 54	° 55	° 56	° 57	° 58	° 59	
0	0.191	201	210	220	230	241	252	263	275	288	60
1	192	201	210	220	230	241	252	264	275	288	59
2	192	201	210	220	231	241	252	264	276	288	58
3	192	201	211	221	231	241	253	264	276	288	57
4	192	201	211	221	231	242	253	264	276	289	56
5	0.192	201	211	221	231	242	253	264	276	289	55
6	192	202	211	221	231	242	253	265	277	289	54
7	192	202	211	221	232	242	253	265	277	289	53
8	193	202	211	221	232	242	253	265	277	289	52
9	193	202	212	222	232	243	254	265	277	290	51
10	0.193	202	212	222	232	243	254	265	277	290	50
11	193	202	212	222	232	243	254	266	278	290	49
12	193	203	212	222	232	243	254	266	278	290	48
13	193	203	212	222	233	243	254	266	278	290	47
14	194	203	212	222	233	243	255	266	278	291	46
15	0.194	203	213	223	233	244	255	266	278	291	45
16	194	203	213	223	233	244	255	267	279	291	44
17	194	203	213	223	233	244	255	267	279	291	43
18	194	203	213	223	233	244	255	267	279	291	42
19	194	204	213	223	234	244	256	267	279	292	41
20	0.194	204	213	223	234	245	256	267	279	292	40
21	195	204	214	224	234	245	256	268	280	292	39
22	195	204	214	224	234	245	256	268	280	292	38
23	195	204	214	224	234	245	256	268	280	293	37
24	195	204	214	224	234	245	256	268	280	293	36
25	0.195	205	214	224	235	245	257	268	280	293	35
26	195	205	214	224	235	246	257	268	281	293	34
27	196	205	215	225	235	246	257	269	281	293	33
28	196	205	215	225	235	246	257	269	281	294	32
29	196	205	215	225	235	246	257	269	281	294	31
30	0.196	205	215	225	236	246	258	269	281	294	30
31	196	206	215	225	236	247	258	269	282	294	29
32	196	206	215	225	236	247	258	270	282	294	28
33	196	206	216	226	236	247	258	270	282	295	27
34	197	206	216	226	236	247	258	270	282	295	26
35	0.197	206	216	226	236	247	259	270	282	295	25
36	197	206	216	226	237	247	259	270	283	295	24
37	197	206	216	226	237	248	259	271	283	296	23
38	197	207	216	226	237	248	259	271	283	296	22
39	197	207	217	227	237	248	259	271	283	296	21
40	0.198	207	217	227	237	248	260	271	283	296	20
41	198	207	217	227	238	248	260	271	284	296	19
42	198	207	217	227	238	249	260	272	284	297	18
43	198	207	217	227	238	249	260	272	284	297	17
44	198	208	217	228	238	249	260	272	284	297	16
45	0.198	208	218	228	238	249	260	272	285	297	15
46	198	208	218	228	238	249	261	272	285	297	14
47	199	208	218	228	239	250	261	273	285	298	13
48	199	208	218	228	239	250	261	273	285	298	12
49	199	208	218	228	239	250	261	273	285	298	11
50	0.199	209	218	229	239	250	261	273	286	298	10
51	199	209	219	229	239	250	262	273	286	299	9
52	199	209	219	229	239	250	262	274	286	299	8
53	200	209	219	229	240	251	262	274	286	299	7
54	200	209	219	229	240	251	262	274	286	299	6
55	0.200	209	219	229	240	251	262	274	287	299	5
56	200	210	219	230	240	251	263	274	287	300	4
57	200	210	220	230	240	251	263	275	287	300	3
58	200	210	220	230	241	252	263	275	287	300	2
59	200	210	220	230	241	252	263	275	287	300	1
60	201	210	220	230	241	252	263	275	288	301	0
	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	M.
	POLAR DISTANCE.								COSECANTS.		

	SECANTS.				LATITUDE.						
M.	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	
0	0.301	314	328	342	358	374	390	408	426	445	60
1	301	314	328	343	358	374	390	408	426	446	59
2	301	314	328	343	358	374	391	408	427	446	58
3	301	315	329	343	358	374	391	409	427	446	57
4	301	315	329	343	359	375	391	409	427	446	56
5	0.302	315	329	344	359	375	392	409	427	447	55
6	302	315	329	344	359	375	392	409	428	447	54
7	302	316	330	344	359	375	392	410	428	447	53
8	302	316	330	344	360	376	392	410	428	448	52
9	303	316	330	345	360	376	393	410	429	448	51
10	0.303	316	330	345	360	376	393	411	429	448	50
11	303	316	331	345	361	377	393	411	429	449	49
12	303	317	331	345	361	377	394	411	430	449	48
13	303	317	331	346	361	377	394	412	430	449	47
14	304	317	331	346	361	377	394	412	430	450	46
15	0.304	317	331	346	362	378	394	412	431	450	45
16	304	318	332	346	362	378	395	412	431	450	44
17	304	318	332	347	362	378	395	413	431	451	43
18	304	318	332	347	362	378	395	413	432	451	42
19	305	318	332	347	363	379	396	413	432	451	41
20	0.305	319	333	347	363	379	396	414	432	452	40
21	305	319	333	348	363	379	396	414	433	452	39
22	305	319	333	348	363	380	396	414	433	452	38
23	306	319	333	348	364	380	397	415	433	453	37
24	306	319	334	348	364	380	397	415	434	453	36
25	0.306	320	334	349	364	380	397	415	434	453	35
26	306	320	334	349	364	381	398	415	434	454	34
27	306	320	334	349	365	381	398	416	434	454	33
28	307	320	335	349	365	381	398	416	435	455	32
29	307	321	335	350	365	382	399	416	435	455	31
30	0.307	321	335	350	366	382	399	417	435	455	30
31	307	321	335	350	366	382	399	417	436	456	29
32	308	321	336	350	366	382	399	417	436	456	28
33	308	322	336	351	366	383	400	418	436	456	27
34	308	322	336	351	367	383	400	418	437	457	26
35	0.308	322	336	351	367	383	400	418	437	457	25
36	309	322	337	352	367	383	401	418	437	457	24
37	309	322	337	352	367	384	401	419	438	458	23
38	309	323	337	352	368	384	401	419	438	458	22
39	309	323	337	352	368	384	401	419	438	458	21
40	0.309	323	338	353	368	385	402	420	439	459	20
41	310	323	338	353	368	385	402	420	439	459	19
42	310	324	338	353	369	385	402	420	439	459	18
43	310	324	338	353	369	385	403	421	440	460	17
44	310	324	339	354	369	386	403	421	440	460	16
45	0.311	324	339	354	370	386	403	421	440	460	15
46	311	325	339	354	370	386	403	422	441	461	14
47	311	325	339	354	370	387	404	422	441	461	13
48	311	325	339	355	370	387	404	422	441	461	12
49	311	325	340	355	371	387	404	423	442	462	11
50	0.312	326	340	355	371	387	405	423	442	462	10
51	312	326	340	355	371	388	405	423	442	462	9
52	312	326	340	356	371	388	405	423	443	463	8
53	312	326	341	356	372	388	406	424	443	463	7
54	313	326	341	356	372	388	406	424	443	463	6
55	0.313	327	341	356	372	389	406	424	444	464	5
56	313	327	341	357	372	389	406	425	444	464	4
57	313	327	342	357	373	389	407	425	444	464	3
58	313	327	342	357	373	390	407	425	445	465	2
59	314	328	342	357	373	390	407	426	445	465	1
60	314	328	342	358	374	390	408	426	445	465	0
	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	M.
	POLAR DISTANCE.								COSECANTS.		

	SECANTS.				LATITUDE.						
	°	°	°	°	°	°	°	°	°	°	
M.	70	71	72	73	74	75	76	77	78	79	
0	0.465	487	510	534	559	587	616	647	682	719	60
1	466	487	510	534	560	587	616	648	682	720	59
2	466	488	510	534	560	587	617	649	683	720	58
3	466	488	511	535	560	588	617	649	683	721	57
4	467	488	511	535	561	588	618	650	684	722	56
5	0.467	489	511	536	561	589	618	650	685	722	55
6	468	489	512	536	562	589	619	651	685	723	54
7	468	489	512	536	562	590	619	651	686	723	53
8	468	490	513	537	563	590	620	652	686	724	52
9	469	490	513	537	563	591	620	652	687	725	51
10	0.469	491	513	538	564	591	621	653	688	725	50
11	469	491	514	538	564	592	621	653	688	726	49
12	470	491	514	539	564	592	622	654	689	727	48
13	470	492	515	539	565	593	622	655	689	727	47
14	470	492	515	539	565	593	623	655	690	728	46
15	0.471	492	515	540	566	594	624	656	691	729	45
16	471	493	516	540	566	594	624	656	691	729	44
17	471	493	516	541	567	595	625	657	692	730	43
18	472	494	517	541	567	595	625	657	692	731	42
19	472	494	517	541	568	596	626	658	693	731	41
20	0.472	494	517	542	568	596	626	659	694	732	40
21	473	495	518	542	569	597	627	659	694	733	39
22	473	495	518	543	569	597	627	660	695	733	38
23	474	495	519	543	569	598	628	660	696	734	37
24	474	496	519	544	570	598	628	661	696	735	36
25	0.474	496	519	544	570	598	629	661	697	735	35
26	475	497	520	544	571	599	629	662	697	736	34
27	475	497	520	545	571	599	630	662	698	737	33
28	475	497	521	545	572	600	630	663	699	738	32
29	476	498	521	546	572	600	631	664	699	738	31
30	0.476	498	521	546	573	601	631	664	700	739	30
31	476	498	522	547	573	601	632	665	700	740	29
32	477	499	522	547	574	602	632	665	701	740	28
33	477	499	523	547	574	602	633	666	702	741	27
34	477	500	523	548	574	603	633	666	702	742	26
35	0.478	500	523	548	575	603	634	667	703	742	25
36	478	500	524	549	575	604	634	668	704	743	24
37	479	501	524	549	576	604	635	668	704	744	23
38	479	501	525	550	576	605	636	669	705	744	22
39	479	501	525	550	577	605	636	669	705	745	21
40	0.480	502	525	550	577	606	637	670	706	746	20
41	480	502	526	551	578	606	637	670	707	746	19
42	480	503	526	551	578	607	638	671	707	747	18
43	481	503	527	552	579	607	638	672	708	748	17
44	481	503	527	552	579	608	639	672	709	749	16
45	0.481	504	527	553	579	608	639	673	709	749	15
46	482	504	528	553	580	609	640	673	710	750	14
47	482	505	528	553	580	609	640	674	711	751	13
48	482	505	529	554	581	610	641	675	711	751	12
49	483	505	529	554	581	610	641	675	712	752	11
50	0.483	506	529	555	582	611	642	676	712	753	10
51	484	506	530	555	582	611	643	676	713	753	9
52	484	506	530	556	583	612	643	677	714	754	8
53	484	507	531	556	583	612	644	677	714	755	7
54	485	507	531	557	584	613	644	678	715	756	6
55	0.485	508	532	557	584	613	645	679	716	756	5
56	485	508	532	557	585	614	645	679	716	757	4
57	486	508	532	558	585	614	646	680	717	758	3
58	486	509	533	558	586	615	646	680	718	758	2
59	486	509	533	559	586	615	647	681	718	759	1
60	487	510	534	559	587	616	647	682	719	760	0
	19°	18°	17°	16	15	14°	13°	12°	11	10	M.
	POLAR DISTANCE.								COSECANTS.		

	SECANTS.				LATITUDE.						
M.	° 80	° 81	° 82	° 83	° 84	° 85	° 86	° 87	° 88	° 89	
0	0.760	805	856	914	0.980	1.059	1.156	1.281	1.457	1.758	60
1	761	806	857	915	981	061	158	283	460	765	59
2	761	807	858	916	983	062	160	286	464	772	58
3	762	808	859	917	984	064	161	288	468	780	57
4	763	808	860	918	985	065	163	290	471	788	56
5	0.763	809	860	919	0.986	1.066	1.165	1.293	1.475	1.795	55
6	764	810	861	920	988	068	167	295	479	803	54
7	765	811	862	921	989	069	169	298	483	812	53
8	766	812	863	922	990	071	171	300	487	820	52
9	766	812	864	923	991	072	172	303	491	828	51
10	0.767	813	865	924	0.992	1.074	1.174	1.306	1.494	1.837	50
11	768	814	866	925	994	075	176	308	498	846	49
12	769	815	867	926	995	077	178	311	502	855	48
13	769	816	868	927	996	078	180	313	506	864	47
14	770	816	869	928	997	080	182	316	511	873	46
15	0.771	817	870	929	0.999	1.081	1.184	1.318	1.515	1.883	45
16	771	818	871	930	1.000	083	186	321	519	892	44
17	772	819	872	931	001	084	188	324	523	902	43
18	773	820	872	933	002	086	190	326	527	913	42
19	774	821	873	934	004	088	192	329	532	923	41
20	0.774	821	874	935	1.005	1.089	1.194	1.332	1.536	1.934	40
21	775	822	875	936	006	091	196	335	540	945	39
22	776	823	876	937	008	092	198	337	545	956	38
23	777	824	877	938	009	094	200	340	549	968	37
24	777	825	878	939	010	095	202	343	554	979	36
25	0.778	826	879	940	1.011	1.097	1.204	1.346	1.558	1.992	35
26	779	826	880	941	013	098	206	348	563	2.004	34
27	780	827	881	942	014	100	208	351	567	017	33
28	780	828	882	943	015	102	210	354	572	031	32
29	781	829	883	945	017	103	212	357	577	044	31
30	0.782	830	884	946	1.018	1.105	1.214	1.360	1.582	2.059	30
31	783	831	885	947	019	106	216	363	586	073	29
32	783	831	886	948	021	108	218	366	591	089	28
33	784	832	887	949	022	110	220	369	596	104	27
34	785	833	888	950	023	111	222	372	601	121	26
35	0.786	834	889	951	1.025	1.113	1.224	1.375	1.606	2.138	25
36	786	835	890	952	026	115	226	378	612	156	24
37	787	836	891	953	027	116	229	381	617	174	23
38	788	837	892	955	029	118	231	384	622	193	22
39	789	837	893	956	030	120	233	387	627	214	21
40	0.790	838	894	957	1.031	1.121	1.235	1.390	1.633	2.235	20
41	790	839	894	958	033	123	237	393	638	257	19
42	791	840	895	959	034	125	239	396	644	281	18
43	792	841	896	960	035	126	242	399	649	305	17
44	793	842	897	961	037	128	244	402	655	332	16
45	0.793	843	898	963	1.038	1.130	1.246	1.406	1.661	2.360	15
46	794	844	899	964	039	131	248	409	667	390	14
47	795	844	900	965	041	133	250	412	672	422	13
48	796	845	901	966	042	135	253	415	678	457	12
49	796	846	902	967	044	136	255	419	685	494	11
50	0.797	847	903	968	1.045	1.138	1.257	1.422	1.691	2.536	10
51	798	848	904	970	046	140	260	425	697	582	9
52	799	849	905	971	048	142	262	429	703	633	8
53	800	850	906	972	049	143	264	432	710	691	7
54	800	851	907	973	051	145	266	436	716	758	6
55	0.801	851	908	974	1.052	1.147	1.269	1.439	1.723	2.837	5
56	802	852	910	975	053	149	271	442	730	931	4
57	803	853	911	977	055	151	274	446	736	3.059	3
58	804	854	912	978	056	152	276	450	743	235	2
59	804	855	913	979	058	154	278	453	750	536	1
60	805	856	914	980	059	156	281	457	758		0
	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	M.
	POLAR DISTANCE.								COSECANTS.		

	0 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								
M.	s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s. 9
0	3/4.	121	723	075	325	519	677	59									
1	4/5.677	811	927	029	121	204	279	58									
2	5.279	349	413	473	129	582	631	57									
3	631	678	723	765	806	844	881	56									
4	5/6 881	917	951	983	015	046	075	55									
5	6.075	103	131	158	184	209	233	54									
6	233	257	280	303	325	346	367	53									
7	367	388	408	427	446	465	483	52									
8	483	501	519	536	553	569	586	51									
9	586	601	617	632	648	662	677	50									
10	6.677	691	705	719	733	747	760	49									
11	760	773	786	798	811	823	835	48									
12	835	847	859	871	882	894	905	47									
13	905	916	927	938	948	959	969	46									
14	969	979	990	000	010	019	029	45									
15	7.029	039	048	058	067	076	085	44	93	187	280	373	467	560	653	746	840
16	085	094	103	112	121	129	138	43	87	175	263	350	438	526	614	702	789
17	138	146	155	163	171	179	187	42	82	165	248	331	413	496	579	662	744
18	187	195	203	211	219	227	234	41	78	156	234	313	391	469	547	625	704
19	234	242	249	257	264	272	279	40	74	148	222	296	370	444	518	592	666
20	7.279	286	293	300	307	314	321	39	70	140	211	281	352	422	492	563	633
21	321	328	335	342	348	355	362	38	67	134	201	268	335	403	470	537	604
22	362	368	375	381	388	394	400	37	64	128	192	256	320	385	449	513	577
23	400	406	413	419	425	431	437	36	61	123	184	245	306	368	430	491	552
24	437	443	449	455	461	467	473	35	59	118	171	235	295	353	412	471	531
25	7.473	478	484	490	495	501	507	34	56	113	169	226	282	339	396	452	509
26	507	512	518	523	529	534	539	33	54	109	163	218	272	327	381	436	490
27	539	545	550	555	560	566	571	32	52	105	157	209	262	314	367	420	472
28	571	576	581	586	591	596	601	31	51	101	152	202	253	303	354	405	455
29	601	606	611	616	621	626	631	30	49	98	147	195	244	293	342	392	441
30	7.631	636	640	645	650	654	659	29	47	95	142	189	236	284	331	378	426
31	659	664	668	673	678	682	687	28	46	92	137	183	229	275	321	366	412
32	687	691	696	700	705	709	713	27	44	89	133	178	222	267	311	355	400
33	713	718	722	726	731	735	739	26	43	86	129	172	215	258	301	344	388
34	739	743	748	752	756	760	764	25	42	83	125	167	209	251	293	334	377
35	7.764	768	773	777	781	785	789	24	41	81	122	162	203	243	284	325	366
36	789	793	797	801	805	809	813	23	40	79	118	158	197	237	277	316	356
37	813	816	820	824	828	832	836	22	39	77	115	154	192	231	270	308	347
38	836	839	843	847	851	854	858	21	38	75	112	150	187	225	263	300	338
39	858	862	866	869	873	876	880	20	37	73	109	146	182	219	256	292	329
40	7.880	884	887	891	894	898	901	19	36	71	106	142	178	213	249	284	321
41	901	905	909	912	915	919	922	18	35	70	104	139	174	208	243	278	313
42	922	926	929	933	936	939	943	17	34	68	102	136	170	204	238	272	306
43	943	946	949	953	956	959	963	16	33	66	100	133	166	199	232	265	299
44	963	966	969	972	976	979	982	15	32	65	97	130	162	194	227	259	292
45	7/8 982	985	988	992	995	998	001	14	32	63	95	127	158	190	222	253	286
46	8.001	004	007	010	014	017	020	13	31	62	93	124	155	186	218	248	279
47	020	023	026	029	032	035	038	12	30	61	91	121	152	182	212	243	273
48	038	041	044	047	050	053	056	11	30	60	89	119	148	178	208	238	268
49	056	059	062	065	068	070	073	10	29	58	87	116	145	175	204	233	262
50	8.073	076	079	082	085	088	090	9	28	57	85	114	142	171	200	228	257
51	090	093	096	099	102	104	107	8	28	56	84	112	140	168	196	224	252
52	107	110	113	115	118	121	124	7	27	55	82	110	138	165	193	220	248
53	124	126	129	132	135	137	140	6	27	54	81	108	135	162	189	216	243
54	140	143	145	148	150	153	156	5	26	53	79	106	133	159	185	212	239
55	8.156	158	161	164	166	169	171	4	26	52	78	104	130	156	182	208	234
56	171	174	176	179	182	184	187	3	25	51	77	102	127	153	179	204	229
57	187	189	192	194	197	199	202	2	25	50	75	100	125	150	175	200	224
58	202	204	207	209	211	214	216	1	24	49	73	98	123	147	172	196	220
59	216	219	221	224	226	228	231	0	24	48	72	96	120	145	169	193	217
	60s.	50s.	40s.	30s.	20s.	10s.	0s.	M.	1s.	2s.	3s.	4s.	5s.	6s.	7s.	8s.	9s.
	23 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								

M.	1 HOUR. s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		PROPORTIONAL PARTS FOR SECONDS. s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s. 9
0	8.231	233	236	238	240	243	245	59	24	47	71	95	118	142	166	190	213
1	245	248	250	252	255	257	259	58	23	47	70	93	116	140	163	187	210
2	259	262	264	266	268	271	273	57	23	46	69	92	115	138	161	184	207
3	273	275	278	280	282	284	287	56	23	45	68	91	113	136	159	181	204
4	287	289	291	293	296	298	300	55	22	44	67	89	111	133	156	178	201
5	8.300	302	304	307	309	311	313	54	22	44	66	87	109	131	153	175	198
6	313	315	318	320	322	324	326	53	22	43	65	86	108	130	151	173	195
7	326	328	330	333	335	337	339	52	21	43	64	85	106	128	149	170	192
8	339	341	343	345	347	349	351	51	21	42	63	84	105	126	147	168	189
9	351	354	356	358	360	362	364	50	21	41	62	83	103	124	145	165	186
10	8.364	366	368	370	372	374	376	49	20	41	61	82	102	122	143	163	184
11	376	378	380	382	384	386	388	48	20	40	60	81	100	120	141	161	181
12	388	390	392	394	396	398	400	47	20	40	60	80	99	119	139	159	179
13	400	402	404	406	408	410	412	46	20	39	59	78	98	118	137	157	177
14	412	414	416	418	419	421	423	45	19	39	58	77	96	116	135	154	174
15	8.423	425	427	429	431	433	435	44	19	38	57	76	95	114	133	152	171
16	435	437	438	440	442	444	446	43	19	37	56	75	93	112	131	150	169
17	446	448	450	452	453	455	457	42	19	37	55	74	92	111	130	148	167
18	457	459	461	463	464	466	468	41	18	37	55	73	91	110	128	146	165
19	468	470	472	473	475	477	479	40	18	36	54	72	90	108	126	144	162
20	8.479	481	482	484	486	488	490	39	18	35	53	71	89	107	125	142	160
21	490	491	493	495	497	498	500	38	18	35	53	70	88	106	123	141	158
22	500	502	504	505	507	509	510	37	17	35	52	70	87	104	122	139	157
23	510	512	514	516	517	519	521	36	17	34	52	69	86	103	120	138	155
24	521	522	524	526	528	529	531	35	17	34	51	68	85	102	119	136	153
25	8.531	533	534	536	538	539	541	34	17	33	50	67	83	100	117	134	151
26	541	543	544	546	548	549	551	33	17	33	50	66	82	99	116	132	149
27	551	553	554	556	557	559	561	32	16	33	49	65	81	98	114	130	147
28	561	562	564	566	567	569	570	31	16	32	48	64	80	97	113	129	145
29	570	572	574	575	577	578	580	30	16	32	48	63	80	96	111	127	143
30	8.580	582	583	585	586	588	589	29	16	32	47	63	79	95	110	126	142
31	589	591	593	594	596	597	599	28	16	31	47	62	78	94	109	125	141
32	599	600	602	603	605	607	608	27	15	31	46	62	77	93	108	123	139
33	608	610	611	613	614	616	617	26	15	30	46	61	77	92	107	122	138
34	617	619	620	622	623	625	626	25	15	30	45	60	76	91	106	121	136
35	8.626	628	629	631	632	634	635	24	15	30	45	60	75	90	105	119	134
36	635	637	638	640	641	643	644	23	15	30	45	59	74	89	104	118	133
37	644	646	647	649	650	651	653	22	15	29	44	58	73	88	102	117	132
38	653	654	656	657	659	660	662	21	15	29	43	58	72	87	101	116	130
39	662	663	664	666	667	669	670	20	14	29	43	57	72	86	100	115	129
40	8.670	672	673	674	676	677	679	19	14	28	43	57	71	85	99	113	128
41	679	680	681	683	684	686	687	18	14	28	42	56	70	84	98	112	126
42	687	688	690	691	693	694	695	17	14	28	42	55	69	83	97	111	125
43	695	697	698	700	701	702	704	16	14	27	41	55	69	82	96	110	124
44	704	705	706	708	709	710	712	15	14	27	41	54	68	82	95	109	123
45	8.712	713	715	716	717	719	720	14	14	27	40	54	67	81	95	108	122
46	720	721	723	724	725	727	728	13	13	27	40	53	67	80	94	107	121
47	728	729	731	732	733	735	736	12	13	26	40	53	66	79	93	106	119
48	736	737	739	740	741	742	744	11	13	26	39	52	65	78	92	105	118
49	744	745	746	748	749	750	752	10	13	26	39	52	65	78	91	104	117
50	8.752	753	754	755	757	758	759	9	13	26	38	51	64	77	90	103	116
51	759	760	762	763	764	766	767	8	13	25	38	51	63	76	89	102	115
52	767	768	769	771	772	773	774	7	13	25	38	50	63	76	88	101	114
53	774	776	777	778	779	781	782	6	13	25	37	50	62	75	87	100	113
54	782	783	784	786	787	788	789	5	12	25	37	50	62	75	87	99	112
55	8.789	791	792	793	794	795	797	4	12	25	37	49	61	74	86	98	111
56	797	798	799	800	802	803	804	3	12	25	37	49	61	73	85	98	110
57	804	805	806	808	809	810	811	2	12	24	36	48	60	73	85	97	109
58	811	812	814	815	816	817	818	1	12	24	36	48	60	72	84	96	108
59	818	820	821	822	823	824	825	0	12	24	36	48	60	72	83	95	107
	60s.	50s.	40s.	30s.	20s.	10s.	0s.	M.	1s.	2s.	3s.	4s.	5s.	6s.	7s.	8s.	9s.
	22 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								

	2 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								
M.	s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s 9
0	8.825	827	828	829	830	831	833	59	12	23	35	47	59	70	82	93	105
1	833	834	835	836	837	838	840	58	12	23	35	46	58	70	81	93	105
2	840	841	842	843	844	845	846	57	11	23	35	46	57	69	80	92	104
3	846	848	849	850	851	852	853	56	11	23	34	45	57	68	80	91	103
4	853	854	856	857	858	859	860	55	11	23	34	45	57	68	79	90	102
5	8.860	861	862	863	865	866	867	54	11	22	34	45	56	67	78	90	101
6	867	868	869	870	871	872	874	53	11	22	33	45	56	67	78	89	100
7	874	875	876	877	878	879	880	52	11	22	33	44	55	66	78	89	100
8	880	881	882	883	885	886	887	51	11	22	33	44	55	66	77	88	99
9	887	888	889	890	891	892	893	50	11	22	33	44	55	65	76	87	98
10	8.893	894	895	897	898	899	900	49	11	22	32	43	54	65	76	86	97
11	900	901	902	903	904	905	906	48	11	21	32	43	54	64	75	86	96
12	906	907	908	909	910	912	913	47	11	21	32	42	53	64	74	85	95
13	913	914	915	916	917	918	919	46	11	21	32	42	53	63	73	84	95
14	919	920	921	922	923	924	925	45	10	21	32	42	53	63	73	84	94
15	8.925	926	927	928	929	930	931	44	10	21	31	42	52	62	73	83	93
16	931	932	933	934	935	937	938	43	10	20	31	41	52	62	72	82	93
17	938	939	940	941	942	943	944	42	10	20	31	41	51	61	71	82	92
18	944	945	946	947	948	949	950	41	10	20	30	40	51	61	71	81	91
19	950	951	952	953	954	955	956	40	10	20	30	40	50	60	70	80	90
20	8.956	957	958	959	960	961	962	39	10	20	30	40	50	60	70	80	90
21	962	963	964	965	966	967	968	38	10	20	30	40	50	60	69	79	89
22	968	969	970	971	972	973	974	37	10	20	30	39	49	59	69	79	88
23	974	975	976	977	978	978	979	36	10	19	29	39	49	59	68	78	87
24	979	980	981	982	983	984	985	35	10	19	29	39	49	58	68	77	87
25	8.985	986	987	988	989	990	991	34	10	19	29	38	48	58	67	77	86
26	991	992	993	994	995	996	997	33	10	19	29	38	48	57	67	76	86
27	8.997	998	999	000	001	002	002	32	9	19	28	38	47	57	66	76	85
28	9.002	003	004	005	006	007	008	31	9	19	28	38	47	56	66	75	85
29	008	009	010	011	012	013	014	30	9	19	28	37	47	56	65	75	84
30	9.014	015	016	016	017	018	019	29	9	18	28	37	46	55	65	74	83
31	019	020	021	022	023	024	025	28	9	18	28	37	46	55	64	74	83
32	025	026	027	028	028	029	030	27	9	18	27	37	46	55	64	73	82
33	030	031	032	033	034	035	036	26	9	18	27	36	45	54	64	73	82
34	036	037	038	038	039	040	041	25	9	18	27	36	45	54	63	72	81
35	9.041	042	043	044	045	046	046	24	9	18	27	36	45	54	63	72	81
36	046	047	048	049	050	051	052	23	9	18	27	36	45	53	62	71	80
37	052	053	054	054	055	056	057	22	9	18	26	35	44	53	62	71	79
38	057	058	059	060	061	062	062	21	9	17	26	35	44	53	61	70	79
39	062	063	064	065	066	067	068	20	9	17	26	35	43	52	61	70	78
40	9.068	068	069	070	071	072	073	19	9	17	26	35	43	52	61	69	78
41	073	074	075	075	076	077	078	18	9	17	26	34	43	52	60	69	77
42	078	079	080	081	081	082	083	17	9	17	26	34	43	51	60	68	77
43	083	084	085	086	086	087	088	16	8	17	25	34	42	51	59	67	76
44	088	089	090	091	092	092	093	15	8	17	25	34	42	51	59	67	76
45	9.093	094	095	096	097	097	098	14	8	17	25	34	42	50	59	67	76
46	098	099	100	101	102	102	103	13	8	17	25	33	42	50	58	66	75
47	103	104	105	106	107	107	108	12	8	16	25	33	41	50	58	66	74
48	108	109	110	111	111	112	113	11	8	16	25	33	41	49	57	66	74
49	113	114	115	116	116	117	118	10	8	16	24	33	41	49	57	65	73
50	9.118	119	120	120	121	122	123	9	8	16	24	32	40	49	57	65	73
51	123	124	124	125	126	127	128	8	8	16	24	32	40	48	56	64	73
52	128	128	129	130	131	132	132	7	8	16	24	32	40	48	56	64	72
53	132	133	134	135	136	136	137	6	8	16	24	32	40	48	56	64	72
54	137	138	139	140	140	141	142	5	8	16	24	32	40	47	55	63	71
55	9.142	143	144	144	145	146	147	4	8	16	24	31	39	47	55	63	71
56	147	147	148	149	150	151	151	3	8	16	23	31	39	47	55	62	70
57	151	152	153	154	154	155	156	2	8	15	23	31	39	47	54	62	70
58	156	157	158	158	159	160	161	1	8	15	23	31	38	46	54	62	69
59	161	161	162	163	164	164	165	0	8	15	23	31	38	46	54	61	69
	60s.	50s.	40s.	30s.	20s.	10s.	0s.	M.	1s.	2s.	3s.	4s.	5s.	6s.	7s.	8s.	9s
	21 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								

	3 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								
M	s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s. 9
0	9.165	166	167	167	168	169	170	59	8	15	23	30	38	46	53	61	68
1	170	171	171	172	173	174	174	58	8	15	23	30	38	45	53	60	68
2	174	175	176	177	177	178	179	57	7	15	22	30	37	45	52	60	67
3	179	180	180	181	182	183	183	56	7	14	22	30	37	45	52	60	67
4	183	184	185	185	186	187	188	55	7	14	22	30	37	44	52	59	67
5	9.188	188	189	190	191	191	192	54	7	14	22	30	37	44	52	59	67
6	192	193	194	194	195	196	197	53	7	14	22	29	37	44	51	59	66
7	197	197	198	199	199	200	201	52	7	14	22	29	37	44	51	58	66
8	201	202	202	203	204	205	205	51	7	14	22	29	36	44	51	58	65
9	205	206	207	207	208	209	210	50	7	14	22	29	36	43	50	58	65
10	9.210	210	211	212	212	213	214	49	7	14	21	29	36	43	50	57	64
11	214	215	215	216	217	217	218	48	7	14	21	28	36	43	50	57	64
12	218	219	220	220	221	222	222	47	7	14	21	28	35	42	49	56	63
13	222	223	224	224	225	226	227	46	7	14	21	28	35	42	49	56	63
14	227	227	228	229	229	230	231	45	7	14	21	28	35	42	49	56	63
15	9.231	231	232	233	234	234	235	44	7	14	21	28	35	42	49	56	63
16	235	236	236	237	238	238	239	43	7	14	21	28	35	41	48	55	62
17	239	240	240	241	242	243	243	42	7	14	21	28	35	41	48	55	62
18	243	244	245	245	246	247	247	41	7	14	21	27	34	41	48	55	62
19	247	248	249	249	250	251	251	40	7	14	20	27	34	41	48	54	61
20	9.251	252	253	253	254	255	255	39	7	14	20	27	34	41	47	54	61
21	255	256	257	257	258	259	259	38	7	13	20	27	34	40	47	54	60
22	259	260	261	261	262	263	263	37	7	13	20	27	34	40	47	54	60
23	263	264	265	265	266	267	267	36	7	13	20	27	33	40	47	53	60
24	267	268	269	269	270	271	271	35	7	13	20	26	33	40	46	53	59
25	9.271	272	273	273	274	275	275	34	7	13	20	26	33	40	46	53	59
26	275	276	277	277	278	279	279	33	7	13	20	26	33	39	46	52	59
27	279	280	281	281	282	283	283	32	6	13	20	26	32	39	46	52	59
28	283	284	284	285	286	286	287	31	6	13	20	26	32	39	46	52	59
29	287	288	288	289	290	290	291	30	6	13	19	26	32	39	45	52	58
30	9.291	292	292	293	293	294	295	29	6	13	19	26	32	38	45	51	58
31	295	295	296	297	297	298	299	28	6	13	19	25	32	38	45	51	57
32	299	299	300	300	301	302	302	27	6	13	19	25	32	38	44	51	57
33	302	303	304	304	305	305	306	26	6	13	19	25	32	38	44	50	57
34	306	307	307	308	309	309	310	25	6	12	19	25	31	38	44	50	56
35	9.310	310	311	312	312	313	314	24	6	12	19	25	31	37	43	50	56
36	314	314	315	315	316	317	317	23	6	12	19	25	31	37	43	50	56
37	317	318	319	319	320	320	321	22	6	12	18	25	31	37	43	49	55
38	321	322	322	323	323	324	325	21	6	12	18	24	31	37	43	49	55
39	325	325	326	326	327	328	328	20	6	12	18	24	31	37	43	49	55
40	9.328	329	330	330	331	331	332	19	6	12	18	24	30	36	42	48	55
41	332	333	333	334	334	335	336	18	6	12	18	24	30	36	42	48	54
42	336	336	337	337	338	339	339	17	6	12	18	24	30	36	42	48	54
43	339	340	340	341	342	342	343	16	6	12	18	24	30	36	42	48	54
44	343	343	344	345	345	346	346	15	6	12	18	24	30	36	41	47	53
45	9.346	347	347	348	349	349	350	14	6	12	18	24	30	35	41	47	53
46	350	350	351	352	352	353	353	13	6	12	18	24	30	35	41	47	53
47	353	354	354	355	356	356	357	12	6	12	18	23	29	35	41	47	53
48	357	357	358	359	359	360	360	11	6	12	17	23	29	35	41	46	52
49	360	361	361	362	363	363	364	10	6	12	17	23	29	35	41	46	52
50	9.364	364	365	365	366	367	367	9	6	11	17	23	29	35	40	46	52
51	367	368	368	369	370	370	371	8	6	11	17	23	29	34	40	46	51
52	371	371	372	372	373	373	374	7	6	11	17	23	29	34	40	46	51
53	374	375	375	376	376	377	377	6	6	11	17	23	28	34	40	45	51
54	377	378	379	379	380	380	381	5	6	11	17	22	28	34	39	45	51
55	9.381	381	382	383	383	384	384	4	6	11	17	22	28	34	39	45	50
56	384	385	385	386	386	387	388	3	6	11	17	22	28	33	39	44	50
57	388	388	389	389	390	390	391	2	6	11	17	22	28	33	39	44	50
58	391	391	392	393	393	394	394	1	6	11	16	22	28	33	39	44	50
59	394	395	395	396	396	397	397	0	6	11	16	22	28	33	39	44	50
	60s.	50s.	40s.	30s.	20s.	10s.	0s.	M.	1s.	2s.	3s.	4s.	5s.	6s.	7s.	8s.	9s.
	20 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								

	4 HOURS.								PROPORTIONAL PARTS FOR SECONDS								
M.	s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s. 9
0	9.397	398	399	399	400	400	401	59	5	11	16	22	28	33	39	44	50
1	401	401	402	402	403	403	404	58	5	11	16	22	27	33	38	44	49
2	404	405	405	406	406	407	407	57	5	11	16	22	27	32	38	43	49
3	407	408	408	409	409	410	410	56	5	11	16	22	27	32	38	43	49
4	410	411	412	412	413	413	414	55	5	11	16	21	27	32	37	43	48
5	9.414	414	415	415	416	416	417	54	5	11	16	21	27	32	37	43	48
6	417	417	418	418	419	419	420	53	5	11	16	21	27	32	37	43	48
7	420	421	421	422	422	423	423	52	5	10	16	21	26	31	37	42	47
8	423	424	424	425	425	426	426	51	5	10	16	21	26	31	37	42	47
9	426	427	427	428	428	429	429	50	5	10	16	21	26	31	36	42	47
10	9 429	430	431	431	432	432	433	49	5	10	16	21	26	31	36	42	47
11	433	433	434	434	435	435	436	48	5	10	15	21	26	31	36	41	46
12	436	436	437	437	438	438	439	47	5	10	15	20	25	31	36	41	46
13	439	439	440	440	441	441	442	46	5	10	15	20	25	31	36	41	46
14	442	442	443	443	444	444	445	45	5	10	15	20	25	31	36	41	46
15	9 445	445	446	446	447	447	448	44	5	10	15	20	25	30	35	40	45
16	448	448	449	449	450	450	451	43	5	10	15	20	25	30	35	40	45
17	451	451	452	452	453	453	454	42	5	10	15	20	25	30	35	40	45
18	454	454	455	455	456	456	457	41	5	10	15	20	25	30	35	40	45
19	457	457	458	458	459	459	460	40	5	10	15	20	25	30	35	40	45
20	9.460	460	461	461	462	462	463	39	5	10	15	20	25	30	35	40	45
21	463	463	464	464	465	465	466	38	5	10	15	20	25	29	34	39	44
22	466	466	467	467	468	468	469	37	5	10	15	20	24	29	34	39	44
23	469	469	470	470	471	471	472	36	5	10	15	20	24	29	34	39	44
24	472	472	473	473	474	474	475	35	5	10	15	19	24	29	34	39	44
25	9.475	475	476	476	477	477	478	34	5	10	14	19	24	29	34	38	43
26	478	478	478	479	479	480	480	33	5	10	14	19	24	29	34	38	43
27	480	481	481	482	482	483	483	32	5	10	14	19	24	29	34	38	43
28	483	484	484	485	485	486	486	31	5	9	14	19	24	29	33	38	43
29	486	487	487	488	488	489	489	30	5	9	14	19	24	28	33	38	42
30	9.489	489	490	490	491	491	492	29	5	9	14	19	23	28	33	38	42
31	492	492	493	493	494	494	495	28	5	9	14	19	23	28	33	38	42
32	495	495	496	496	496	497	497	27	5	9	14	19	23	28	33	37	42
33	497	498	498	499	499	500	500	26	5	9	14	19	23	28	33	37	42
34	500	501	501	502	502	503	503	25	5	9	14	19	23	28	33	37	42
35	9.503	503	504	504	505	505	506	24	5	9	14	18	23	28	32	37	41
36	506	506	507	507	508	508	509	23	5	9	14	18	23	28	32	37	41
37	509	509	509	510	510	511	511	22	5	9	14	18	23	27	32	36	41
38	511	512	512	513	513	514	514	21	5	9	14	18	23	27	32	36	41
39	514	514	515	515	516	516	517	20	4	9	13	18	22	27	31	36	4
40	9.517	517	518	518	518	519	519	19	4	9	13	18	22	27	31	36	40
41	519	520	520	521	521	522	522	18	4	9	13	18	22	27	31	36	40
42	522	523	523	523	524	524	525	17	4	9	13	18	22	27	31	36	40
43	525	525	526	526	527	527	527	16	4	9	13	18	22	27	31	36	40
44	527	528	528	529	529	530	530	15	4	9	13	18	22	27	31	35	40
45	9.530	531	531	531	532	532	533	14	4	9	13	18	22	26	31	35	40
46	533	533	534	534	534	535	535	13	4	9	13	18	22	26	31	35	40
47	535	536	536	537	537	538	538	12	4	9	13	17	22	26	30	35	39
48	538	538	539	539	540	540	541	11	4	9	13	17	22	26	30	35	39
49	541	541	541	542	542	543	543	10	4	9	13	17	22	26	30	35	39
50	9.543	544	544	544	545	545	546	9	4	9	13	17	22	26	30	34	39
51	546	546	547	547	547	548	548	8	4	9	13	17	22	26	30	34	39
52	548	549	549	550	550	550	551	7	4	8	13	17	21	26	30	34	38
53	551	551	552	552	553	553	553	6	4	8	13	17	21	26	30	34	38
54	553	554	554	555	555	555	556	5	4	8	13	17	21	25	29	34	38
55	9.556	556	557	557	558	558	558	4	4	8	13	17	21	25	29	34	38
56	558	559	559	560	560	561	561	3	4	8	13	17	21	25	29	34	38
57	561	561	562	562	563	563	563	2	4	8	12	17	21	25	29	33	37
58	563	564	564	565	565	566	566	1	4	8	12	17	21	25	29	33	37
59	566	566	567	567	568	568	568	0	4	8	12	16	20	25	29	33	37
	60s.	50s.	40s.	30s.	20s.	10s.	0s.	M.	1s	2s.	3s.	4s.	5s.	6s	7s.	8s.	9s.
	19 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								

	5 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								
M.	s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s. 9
0	9.568	569	569	570	570	570	571	59	4	8	12	16	20	25	29	33	37
1	571	571	572	572	572	573	573	58	4	8	12	16	20	25	29	33	37
2	573	574	574	575	575	575	576	57	4	8	12	16	20	25	29	33	37
3	576	576	577	577	577	578	578	56	4	8	12	16	20	24	28	32	36
4	578	579	579	579	580	580	581	55	4	8	12	16	20	24	28	32	36
5	9.581	581	581	582	582	583	583	54	4	8	12	16	20	24	28	32	36
6	583	583	584	584	585	585	585	53	4	8	12	16	20	24	28	32	36
7	585	586	586	587	587	587	588	52	4	8	12	16	20	24	28	32	36
8	588	588	589	589	589	590	590	51	4	8	12	16	20	24	28	32	36
9	590	591	591	591	592	592	593	50	4	8	12	16	20	24	28	32	36
10	9.593	593	593	594	594	595	595	49	4	8	12	16	20	24	28	32	36
11	595	595	596	596	596	597	597	48	4	8	12	16	20	23	27	31	35
12	597	598	598	598	599	599	600	47	4	8	12	16	20	23	27	31	35
13	600	600	600	601	601	602	602	46	4	8	12	16	20	23	27	31	35
14	602	602	603	603	603	604	604	45	4	8	12	16	20	23	27	31	35
15	9.604	605	605	605	606	606	607	44	4	8	12	15	19	23	27	31	35
16	607	607	607	608	608	608	609	43	4	8	12	15	19	23	27	31	35
17	609	609	610	610	610	611	611	42	4	8	11	15	19	23	27	30	34
18	611	611	612	612	613	613	613	41	4	8	11	15	19	23	27	30	34
19	613	614	614	615	615	615	616	40	4	8	11	15	19	23	27	30	34
20	9.616	616	616	617	617	618	618	39	4	8	11	15	19	23	27	30	34
21	618	618	619	619	619	620	620	38	4	7	11	15	19	22	26	30	34
22	620	621	621	621	622	622	622	37	4	7	11	15	19	22	26	30	34
23	622	623	623	623	624	624	625	36	4	7	11	15	18	22	26	30	33
24	625	625	625	626	626	626	627	35	4	7	11	15	18	22	26	30	33
25	9.627	627	628	628	628	629	629	34	4	7	11	15	18	22	26	30	33
26	629	629	630	630	630	631	631	33	4	7	11	15	18	22	26	29	33
27	631	632	632	632	633	633	633	32	4	7	11	15	18	22	26	29	33
28	633	634	634	634	635	635	636	31	4	7	11	14	18	22	25	29	32
29	636	636	636	637	637	637	638	30	4	7	11	14	18	22	25	29	32
30	9.638	638	638	639	639	640	640	29	4	7	11	14	18	22	25	29	32
31	640	640	641	641	641	642	642	28	4	7	11	14	18	22	25	29	32
32	642	642	643	643	643	644	644	27	4	7	11	14	18	21	25	28	32
33	644	645	645	645	646	646	646	26	4	7	11	14	18	21	25	28	32
34	646	647	647	647	648	648	648	25	4	7	11	14	18	21	25	28	32
35	9.648	649	649	649	650	650	651	24	4	7	10	14	18	21	25	28	31
36	651	651	651	652	652	652	653	23	3	7	10	14	18	21	25	28	31
37	653	653	653	654	654	654	655	22	3	7	10	14	18	21	25	28	31
38	655	655	655	656	656	656	657	21	3	7	10	14	18	21	25	28	31
39	657	657	657	658	658	659	659	20	3	7	10	14	17	21	24	28	31
40	9.659	659	660	660	660	661	661	19	3	7	10	14	17	21	24	28	31
41	661	661	662	662	662	663	663	18	3	7	10	14	17	21	24	28	31
42	663	663	664	664	664	665	665	17	3	7	10	14	17	20	24	27	31
43	665	665	666	666	666	667	667	16	3	7	10	14	17	20	24	27	30
44	667	667	668	668	668	669	669	15	3	7	10	14	17	20	24	27	30
45	9.669	669	670	670	670	671	671	14	3	7	10	14	17	20	24	27	30
46	671	671	672	672	672	673	673	13	3	7	10	13	17	20	23	27	30
47	673	673	674	674	674	675	675	12	3	7	10	13	17	20	23	27	30
48	675	675	676	676	676	677	677	11	3	7	10	13	17	20	23	27	30
49	677	677	678	678	678	679	679	10	3	7	10	13	16	20	23	26	30
50	9.679	679	680	680	680	681	681	9	3	7	10	13	16	20	23	26	30
51	681	681	682	682	682	683	683	8	3	7	10	13	16	20	23	26	30
52	683	683	684	684	684	685	685	7	3	7	10	13	16	19	23	26	29
53	685	685	686	686	686	687	687	6	3	7	10	13	16	19	23	26	29
54	687	687	688	688	688	689	689	5	3	7	10	13	16	19	23	26	29
55	9.689	689	690	690	690	691	691	4	3	6	10	13	16	19	22	26	29
56	691	691	691	692	692	692	693	3	3	6	10	13	16	19	22	26	29
57	693	693	693	694	694	694	695	2	3	6	10	13	16	19	22	26	29
58	695	695	695	696	696	696	697	1	3	6	10	13	16	19	22	26	29
59	697	697	697	698	698	698	698	0	3	6	10	13	16	19	22	26	29
	60s.	50s.	40s.	30s.	20s.	10s.	0s.	M.	1s.	2s.	3s.	4s.	5s.	6s.	7s.	8s.	9s
	18 HOURS.								PROPORTIONAL PARTS FOR SECONDS								

M.	6 HOURS. s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		PROPORTIONAL PARTS FOR SECONDS. s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s. 9
0	9.698	699	699	699	700	700	700	59	3	6	9	13	16	19	22	25	28
1	700	701	701	701	702	702	702	58	3	6	9	13	16	19	22	25	28
2	702	703	703	703	703	704	704	57	3	6	9	13	16	19	22	25	28
3	704	704	705	705	705	706	706	56	3	6	9	12	15	19	22	25	28
4	706	706	707	707	707	708	708	55	3	6	9	12	15	19	22	25	28
5	9.708	708	708	709	709	709	710	54	3	6	9	12	15	19	22	25	28
6	710	710	710	711	711	711	712	53	3	6	9	12	15	19	22	25	28
7	712	712	712	712	713	713	713	52	3	6	9	12	15	18	21	24	27
8	713	714	714	714	715	715	715	51	3	6	9	12	15	18	21	24	27
9	715	716	716	716	716	717	717	50	3	6	9	12	15	18	21	24	27
10	9.717	717	718	718	718	719	719	49	3	6	9	12	15	18	21	24	27
11	719	719	719	720	720	720	721	48	3	6	9	12	15	18	21	24	27
12	721	721	721	722	722	722	722	47	3	6	9	12	15	18	21	24	27
13	722	723	723	723	724	724	724	46	3	6	9	12	15	18	21	24	27
14	724	725	725	725	725	726	726	45	3	6	9	12	15	18	21	24	27
15	9.726	726	727	727	727	727	728	44	3	6	9	12	15	18	21	24	27
16	728	728	728	729	729	729	730	43	3	6	9	12	15	18	21	24	27
17	730	730	730	730	731	731	731	42	3	6	9	12	14	17	20	23	26
18	731	732	732	732	732	733	733	41	3	6	9	12	14	17	20	23	26
19	733	733	734	734	734	734	735	40	3	6	9	12	14	17	20	23	26
20	9.735	735	735	736	736	736	736	39	3	6	9	12	14	17	20	23	26
21	736	737	737	737	738	738	738	38	3	6	9	11	14	17	20	23	26
22	738	739	739	739	739	740	740	37	3	6	9	11	14	17	20	23	26
23	740	740	741	741	741	741	742	36	3	6	9	11	14	17	20	23	26
24	742	742	742	743	743	743	743	35	3	6	9	11	14	17	20	23	26
25	9.743	744	744	744	744	745	745	34	3	6	8	11	14	17	20	22	25
26	745	745	746	746	746	746	747	33	3	6	8	11	14	17	20	22	25
27	747	747	747	748	748	748	748	32	3	6	8	11	14	17	20	22	25
28	748	749	749	749	750	750	750	31	3	6	8	11	14	17	20	22	25
29	750	750	751	751	751	751	752	30	3	6	8	11	14	17	20	22	25
30	9.752	752	752	753	753	753	753	29	3	5	8	11	14	16	19	22	25
31	753	754	754	754	755	755	755	28	3	5	8	11	14	16	19	22	25
32	755	755	756	756	756	756	757	27	3	5	8	11	14	16	19	22	25
33	757	757	757	758	758	758	758	26	3	5	8	11	14	16	19	22	25
34	758	759	759	759	759	760	760	25	3	5	8	11	14	16	19	22	24
35	9.760	760	761	761	761	761	762	24	3	5	8	11	14	16	19	22	24
36	762	762	762	762	763	763	763	23	3	5	8	11	14	16	19	22	24
37	763	763	764	764	764	765	765	22	3	5	8	11	14	16	19	21	24
38	765	765	765	766	766	766	766	21	3	5	8	11	14	16	19	21	24
39	766	767	767	767	767	768	768	20	3	5	8	11	13	16	19	21	24
40	9.768	768	769	769	769	769	770	19	3	5	8	11	13	16	18	21	24
41	770	770	770	770	771	771	771	18	3	5	8	11	13	16	18	21	24
42	771	771	772	772	772	772	773	17	3	5	8	10	13	16	18	21	24
43	773	773	773	774	774	774	774	16	3	5	8	10	13	16	18	21	24
44	774	775	775	775	775	776	776	15	3	5	8	10	13	16	18	21	23
45	9.776	776	776	777	777	777	777	14	3	5	8	10	13	15	18	21	23
46	777	778	778	778	778	779	779	13	3	5	8	10	13	15	18	21	23
47	779	779	779	780	780	780	781	12	3	5	8	10	13	15	18	21	23
48	781	781	781	781	782	782	782	11	3	5	8	10	13	15	18	20	23
49	782	782	783	783	783	783	784	10	3	5	8	10	13	15	18	20	23
50	9.784	784	784	784	785	785	785	9	3	5	8	10	13	15	17	20	23
51	785	785	786	786	786	786	787	8	3	5	7	10	13	15	17	20	23
52	787	787	787	787	788	788	788	7	3	5	7	10	13	15	17	20	23
53	788	788	789	789	789	789	790	6	3	5	7	10	13	15	17	20	23
54	790	790	790	790	791	791	791	5	2	5	7	10	13	15	17	20	23
55	9.791	791	792	792	792	792	793	4	2	5	7	10	13	15	17	20	23
56	793	793	793	793	794	794	794	3	2	5	7	10	13	15	17	20	22
57	794	794	795	795	795	795	796	2	2	5	7	10	12	15	17	20	22
58	796	796	796	796	796	797	797	1	2	5	7	10	12	15	17	20	22
59	797	797	797	798	798	798	798	0	2	5	7	10	12	15	17	20	22
	60s.	50s.	40s.	30s.	20s.	10s.	0s.	M.	1s.	2s.	3s.	4s.	5s.	6s.	7s.	8s.	9s.
	17 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								

	7 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								
M.	s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s. 9
0	9.798	799	799	799	799	800	800	59	2	5	7	10	12	14	17	19	22
1	800	800	800	801	801	801	801	58	2	5	7	10	12	14	17	19	22
2	801	802	802	802	802	803	803	57	2	5	7	10	12	14	17	19	22
3	803	803	803	803	804	804	804	56	2	5	7	10	12	14	17	19	22
4	804	804	805	805	805	805	806	55	2	5	7	9	12	14	16	19	21
5	9.806	806	806	806	807	807	807	54	2	5	7	9	12	14	16	19	21
6	807	807	808	808	808	808	808	53	2	5	7	9	12	14	16	19	21
7	808	809	809	809	809	810	810	52	2	5	7	9	12	14	16	19	21
8	810	810	810	811	811	811	811	51	2	5	7	9	11	14	16	18	21
9	811	811	812	812	812	812	813	50	2	5	7	9	11	14	16	18	21
10	9.813	813	813	813	814	814	814	49	2	5	7	9	11	14	16	18	21
11	814	814	815	815	815	815	815	48	2	5	7	9	11	14	16	18	21
12	815	816	816	816	816	817	817	47	2	5	7	9	11	14	16	18	21
13	817	817	817	817	818	818	818	46	2	5	7	9	11	14	16	18	21
14	818	818	819	819	819	819	820	45	2	5	7	9	11	14	16	18	20
15	9.820	820	820	820	820	821	821	44	2	5	7	9	11	14	16	18	20
16	821	821	821	822	822	822	822	43	2	5	7	9	11	14	16	18	20
17	822	822	823	823	823	823	824	42	2	5	7	9	11	14	16	18	20
18	824	824	824	824	824	825	825	41	2	5	7	9	11	14	16	18	20
19	825	825	825	826	826	826	826	40	2	4	7	9	11	13	15	18	20
20	9.826	826	827	827	827	827	828	39	2	4	7	9	11	13	15	18	20
21	828	828	828	828	828	829	829	38	2	4	7	9	11	13	15	18	20
22	829	829	829	830	830	830	830	37	2	4	7	9	11	13	15	18	20
23	830	830	831	831	831	831	831	36	2	4	7	9	11	13	15	18	20
24	831	832	832	832	832	833	833	35	2	4	6	9	11	13	15	17	19
25	9.833	833	833	833	834	834	834	34	2	4	6	9	11	13	15	17	19
26	834	834	835	835	835	835	835	33	2	4	6	9	11	13	15	17	19
27	835	836	836	836	836	836	837	32	2	4	6	9	11	13	15	17	19
28	837	837	837	837	838	838	838	31	2	4	6	9	11	13	15	17	19
29	838	838	838	839	839	839	839	30	2	4	6	8	11	13	15	17	19
30	9.839	839	840	840	840	840	840	29	2	4	6	8	11	13	15	17	19
31	840	841	841	841	841	842	842	28	2	4	6	8	11	13	15	17	19
32	842	842	842	842	843	843	843	27	2	4	6	8	11	13	15	17	19
33	843	843	843	844	844	844	844	26	2	4	6	8	11	13	15	17	19
34	844	844	845	845	845	845	845	25	2	4	6	8	10	12	14	16	18
35	9.845	846	846	846	846	846	847	24	2	4	6	8	10	12	14	16	18
36	847	847	847	847	848	848	848	23	2	4	6	8	10	12	14	16	18
37	848	848	848	849	849	849	849	22	2	4	6	8	10	12	14	16	18
38	849	849	850	850	850	850	850	21	2	4	6	8	10	12	14	16	18
39	850	851	851	851	851	851	852	20	2	4	6	8	10	12	14	16	18
40	9.852	852	852	852	852	853	853	19	2	4	6	8	10	12	14	16	18
41	853	853	853	853	854	854	854	18	2	4	6	8	10	12	14	16	18
42	854	854	854	855	855	855	855	17	2	4	6	8	10	12	14	16	18
43	855	855	856	856	856	856	856	16	2	4	6	8	10	12	14	16	18
44	856	857	857	857	857	857	858	15	2	4	6	8	10	12	14	16	18
45	9.858	858	858	858	858	859	859	14	2	4	6	8	10	12	14	16	18
46	859	859	859	859	859	860	860	13	2	4	6	8	10	12	14	16	18
47	860	860	860	860	861	861	861	12	2	4	6	8	10	12	14	16	18
48	861	861	861	862	862	862	862	11	2	4	6	8	10	12	14	16	18
49	862	862	863	863	863	863	863	10	2	4	6	8	10	12	14	16	18
50	9.863	864	864	864	864	864	864	9	2	4	6	8	9	11	13	15	17
51	864	865	865	865	865	865	866	8	2	4	6	8	9	11	13	15	17
52	866	866	866	866	866	867	867	7	2	4	6	8	9	11	13	15	17
53	867	867	867	867	868	868	868	6	2	4	6	8	9	11	13	15	17
54	868	868	868	868	869	869	869	5	2	4	6	8	9	11	13	15	17
55	9.869	869	869	870	870	870	870	4	2	4	6	8	9	11	13	15	17
56	870	870	871	871	871	871	871	3	2	4	6	7	9	11	13	15	17
57	871	871	872	872	872	872	872	2	2	4	6	7	9	11	13	15	17
58	872	873	873	873	873	873	873	1	2	4	6	7	9	11	13	15	17
59	873	874	874	874	874	874	875	0	2	4	6	7	9	11	13	15	17
	60s.	50s.	40s	30s.	20s.	10s.	0s.	M.	1s.	2s.	3s.	4s.	5s.	6s.	7s	8s.	9s.
	16 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								

	8 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								
M.	s. 0	s. 10	s. 20	s. 30	s. 40	s. 50	s. 60		s. 1	s. 2	s. 3	s. 4	s. 5	s. 6	s. 7	s. 8	s. 9
0	9.875	875	875	875	875	875	876	59	2	4	5	7	9	11	13	14	16
1	876	876	876	876	876	877	877	58	2	4	5	7	9	11	13	14	16
2	877	877	877	877	877	878	878	57	2	4	5	7	9	11	13	14	16
3	878	878	878	878	879	879	879	56	2	4	5	7	9	11	13	14	16
4	879	879	879	879	880	880	880	55	2	4	5	7	9	11	13	14	16
5	9.880	880	880	881	881	881	881	54	2	4	5	7	9	11	13	14	16
6	881	881	881	882	882	882	882	53	2	3	5	7	9	11	12	14	16
7	882	882	882	883	883	883	883	52	2	3	5	7	9	11	12	14	16
8	883	883	883	884	884	884	884	51	2	3	5	7	9	11	12	14	16
9	884	884	885	885	885	885	885	50	2	3	5	7	9	11	12	14	16
10	9.885	885	886	886	886	886	886	49	2	3	5	7	8	10	12	14	15
11	886	886	887	887	887	887	887	48	2	3	5	7	8	10	12	14	15
12	887	887	888	888	888	888	888	47	2	3	5	7	8	10	12	14	15
13	888	888	889	889	889	889	889	46	2	3	5	7	8	10	12	14	15
14	889	890	890	890	890	890	890	45	2	3	5	7	8	10	12	14	15
15	9.890	891	891	891	891	891	891	44	2	3	5	7	8	10	12	14	15
16	891	892	892	892	892	892	892	43	2	3	5	7	8	10	12	14	15
17	892	893	893	893	893	893	893	42	2	3	5	7	8	10	12	14	15
18	893	894	894	894	894	894	894	41	2	3	5	7	8	10	12	13	15
19	894	895	895	895	895	895	895	40	2	3	5	7	8	10	12	13	15
20	9.895	896	896	896	896	896	896	39	2	3	5	7	8	10	12	13	15
21	896	897	897	897	897	897	897	38	2	3	5	7	8	10	12	13	15
22	897	897	898	898	898	898	898	37	2	3	5	7	8	10	12	13	15
23	898	898	899	899	899	899	899	36	2	3	5	6	8	10	11	13	14
24	899	899	900	900	900	900	900	35	2	3	5	6	8	10	11	13	14
25	9.900	900	901	901	901	901	901	34	2	3	5	6	8	10	11	13	14
26	901	901	902	902	902	902	902	33	2	3	5	6	8	10	11	13	14
27	902	902	902	903	903	903	903	32	2	3	5	6	8	10	11	13	14
28	903	903	903	904	904	904	904	31	2	3	5	6	8	10	11	13	14
29	904	904	904	904	905	905	905	30	2	3	5	6	8	10	11	13	14
30	9.905	905	905	905	906	906	906	29	2	3	5	6	8	9	11	12	14
31	906	906	906	906	907	907	907	28	2	3	5	6	8	9	11	12	14
32	907	907	907	907	907	908	908	27	2	3	5	6	8	9	11	12	14
33	908	908	908	908	908	909	909	26	2	3	5	6	8	9	11	12	14
34	909	909	909	909	909	909	910	25	2	3	5	6	8	9	11	12	14
35	9.910	910	910	910	910	910	910	24	2	3	4	6	7	9	10	12	14
36	910	911	911	911	911	911	911	23	2	3	4	6	7	9	10	12	14
37	911	912	912	912	912	912	912	22	2	3	4	6	7	9	10	12	14
38	912	912	913	913	913	913	913	21	2	3	4	6	7	9	10	12	14
39	913	913	913	914	914	914	914	20	2	3	4	6	7	9	10	12	14
40	9.914	914	914	914	915	915	915	19	1	3	4	6	7	9	10	12	13
41	915	915	915	915	916	916	916	18	1	3	4	6	7	9	10	12	13
42	916	916	916	916	916	917	917	17	1	3	4	6	7	9	10	12	13
43	917	917	917	917	917	917	918	16	1	3	4	6	7	9	10	12	13
44	918	918	918	918	918	918	918	15	1	3	4	6	7	9	10	12	13
45	9.918	919	919	919	919	919	919	14	1	3	4	6	7	8	10	11	13
46	919	919	920	920	920	920	920	13	1	3	4	6	7	8	10	11	13
47	920	920	920	921	921	921	921	12	1	3	4	6	7	8	10	11	13
48	921	921	921	921	922	922	922	11	1	3	4	6	7	8	10	11	13
49	922	922	922	922	922	923	923	10	1	3	4	6	7	8	10	11	13
50	9.923	923	923	923	923	923	923	9	1	3	4	6	7	8	10	11	13
51	923	924	924	924	924	924	924	8	1	3	4	6	7	8	10	11	13
52	924	924	925	925	925	925	925	7	1	3	4	5	7	8	9	11	12
53	925	925	925	926	926	926	926	6	1	3	4	5	7	8	9	11	12
54	926	926	926	926	926	927	927	5	1	3	4	5	7	8	9	11	12
55	9.927	927	927	927	927	927	928	4	1	3	4	5	7	8	9	11	12
56	928	928	928	928	928	928	928	3	1	3	4	5	7	8	9	11	12
57	928	928	929	929	929	929	929	2	1	3	4	5	7	8	9	11	12
58	929	929	929	930	930	930	930	1	1	3	4	5	7	8	9	10	12
59	930	930	930	930	930	931	931	0	1	3	4	5	7	8	9	10	12
	60s.	50s.	40s.	30s.	20s.	10s.	0s.	M.	1s.	2s.	3s.	4s.	5s.	6s.	7s	8s.	9s.
	15 HOURS.								PROPORTIONAL PARTS FOR SECONDS.								

Degrees.	Time. H. M.	Degrees.	Time. H. M.	Degrees.	Time. H. M.	Minutes of Degrees.	Time. M. S.	Seconds of Degrees.	Time. S. T.
1	0. 4	61	4. 4	121	8. 4	1	0. 4	1	0. 4
2	0. 8	62	4. 8	122	8. 8	2	0. 8	2	0. 8
3	0.12	63	4.12	123	8.12	3	0.12	3	0.12
4	0.16	64	4.16	124	8.16	4	0.16	4	0.16
5	0.20	65	4.20	125	8.20	5	0.20	5	0.20
6	0.24	66	4.24	126	8.24	6	0.24	6	0.24
7	0.28	67	4.28	127	8.28	7	0.28	7	0.28
8	0.32	68	4.32	128	8.32	8	0.32	8	0.32
9	0.36	69	4.36	129	8.36	9	0.36	9	0.36
10	0.40	70	4.40	130	8.40	10	0.40	10	0.40
11	0.44	71	4.44	131	8.44	11	0.44	11	0.44
12	0.48	72	4.48	132	8.48	12	0.48	12	0.48
13	0.52	73	4.52	133	8.52	13	0.52	13	0.52
14	0.56	74	4.56	134	8.56	14	0.56	14	0.56
15	1. 0	75	5. 0	135	9. 0	15	1. 0	15	1. 0
16	1. 4	76	5. 4	136	9. 4	16	1. 4	16	1. 4
17	1. 8	77	5. 8	137	9. 8	17	1. 8	17	1. 8
18	1.12	78	5.12	138	9.12	18	1.12	18	1.12
19	1.16	79	5.16	139	9.16	19	1.16	19	1.16
20	1.20	80	5.20	140	9.20	20	1.20	20	1.20
21	1.24	81	5.24	141	9.24	21	1.24	21	1.24
22	1.28	82	5.28	142	9.28	22	1.28	22	1.28
23	1.32	83	5.32	143	9.32	23	1.32	23	1.32
24	1.36	84	5.36	144	9.36	24	1.36	24	1.36
25	1.40	85	5.40	145	9.40	25	1.40	25	1.40
26	1.44	86	5.44	146	9.44	26	1.44	26	1.44
27	1.48	87	5.48	147	9.48	27	1.48	27	1.48
28	1.52	88	5.52	148	9.52	28	1.52	28	1.52
29	1.56	89	5.56	149	9.56	29	1.56	29	1.56
30	2. 0	90	6. 0	150	10. 0	30	2. 0	30	2. 0
31	2. 4	91	6. 4	151	10. 4	31	2. 4	31	2. 4
32	2. 8	92	6. 8	152	10. 8	32	2. 8	32	2. 8
33	2.12	93	6 12	153	10.12	33	2.12	33	2.12
34	2.16	94	6.16	154	10.16	34	2.16	34	2.16
35	2.20	95	6.20	155	10.20	35	2.20	35	2.20
36	2.24	96	6.24	156	10.24	36	2.24	36	2.24
37	2.28	97	6.28	157	10.28	37	2.28	37	2.28
38	2 32	98	6.32	158	10.32	38	2.32	38	2.32
39	2.36	99	6.36	159	10.36	39	2.36	39	2.36
40	2.40	100	6.40	160	10.40	40	2.40	40	2.40
41	2.44	101	6.44	161	10.44	41	2.44	41	2.44
42	2.48	102	6.48	162	10.48	42	2.48	42	2.48
43	2.52	103	6.52	163	10.52	43	2.52	43	2.52
44	2.56	104	6.56	164	10.56	44	2.56	44	2.56
45	3. 0	105	7. 0	165	11. 0	45	3. 0	45	3. 0
46	3. 4	106	7. 4	166	11. 4	46	3. 4	46	3. 4
47	3. 8	107	7. 8	167	11. 8	47	3. 8	47	3. 8
48	3.12	108	7.12	168	11.12	48	3.12	48	3.12
49	3.16	109	7.16	169	11.16	49	3.16	49	3.16
50	3.20	110	7.20	170	11.20	50	3.20	50	3.20
51	3.24	111	7.24	171	11.24	51	3.24	51	3.24
52	3.28	112	7.28	172	11.28	52	3.28	52	3.28
53	3.32	113	7.32	173	11.32	53	3.32	53	3.32
54	3.36	114	7.36	174	11.36	54	3.36	54	3.36
55	3.40	115	7.40	175	11.40	55	3.40	55	3.40
56	3.44	116	7.44	176	11.44	56	3.44	56	3.44
57	3.48	117	7.48	177	11.48	57	3.48	57	3.48
58	3.52	118	7.52	178	11.52	58	3.52	58	3.52
59	3.56	119	7.56	179	11.56	59	3.56	59	3.56
60	4. 0	120	8. 0	180	12. 0	60	4. 0	60	4. 0

CALENDAR,

Showing the Sun's Declination at Noon, Equation of Time, High Water at London Bridge, etc.

1864.

JANUARY.

D. of W.	D. of M.	High Water London morn.	High Water Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Add.	The Sun's Declination at Noon.	Diff. of ⊙'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
F	1	6 15	6 34	8 8	4 0	18 45 15	3 38	23 2 52s	12.0	16 18
S	2	6 54	7 16	8 8	4 1	18 49 40	4 6	22 57 52	13.1	16 18
♄	3	7 40	8 8	8 8	4 2	18 54 4	4 34	22 52 24	14.2	16 18
M	4	8 42	9 17	8 8	4 3	18 58 28	5 2	22 46 29	15.4	16 18
Tu	5	9 53	10 30	8 8	4 3	19 2 52	5 29	22 40 6	16.5	16 18
W	6	11 9	11 44	8 7	4 4	19 7 16	5 56	22 33 17	17.6	16 18
Th	7	——	0 15	8 7	4 6	19 11 39	6 23	22 26 1	18.7	16 18
F	8	0 44	1 10	8 7	4 7	19 16 1	6 49	22 18 18	19.8	16 18
S	9	1 37	2 2	8 6	4 9	19 20 23	7 14	22 10 9	20.9	16 18
♄	10	2 26	2 51	8 6	4 10	19 24 45	7 39	22 1 34	22.0	16 18
M	11	3 15	3 39	8 5	4 11	19 29 6	8 3	21 52 33	23.1	16 18
Tu	12	4 1	4 25	8 4	4 13	19 33 26	8 27	21 43 7	24.1	16 18
W	13	4 50	5 12	8 3	4 14	19 37 46	8 50	21 33 16	25.2	16 18
Th	14	5 34	5 57	8 2	4 16	19 42 5	9 13	21 22 59	26.2	16 18
F	15	6 19	6 42	8 2	4 18	19 46 23	9 34	21 12 18	27.2	16 18
S	16	7 6	7 30	8 1	4 19	19 50 41	9 55	21 1 13	28.2	16 18
♄	17	7 59	8 32	8 0	4 21	19 54 57	10 16	20 49 43	29.2	16 18
M	18	9 9	9 46	7 59	4 22	19 59 14	10 35	20 37 50	30.2	16 18
Tu	19	10 25	11 4	7 58	4 24	20 3 29	10 54	20 25 34	31.2	16 17
W	20	11 43	——	7 57	4 25	20 7 44	11 13	20 12 54	32.1	16 17
Th	21	0 15	0 44	7 56	4 27	20 11 58	11 30	19 59 52	33.1	16 17
F	22	1 10	1 33	7 55	4 29	20 16 11	11 47	19 46 28	34.0	16 17
S	23	1 55	2 14	7 54	4 31	20 20 23	12 2	19 32 41	34.9	16 17
♄	24	2 33	2 50	7 53	4 33	20 24 35	12 17	19 18 33	35.8	16 17
M	25	3 6	3 23	7 51	4 35	20 28 46	12 32	19 4 3	36.7	16 17
Tu	26	3 39	3 53	7 50	4 37	20 32 56	12 45	18 49 13	37.6	16 17
W	27	4 9	4 24	7 48	4 39	20 37 5	12 58	18 34 2	38.4	16 17
Th	28	4 39	4 55	7 47	4 40	20 41 14	13 10	18 18 30	39.2	16 17
F	29	5 11	5 26	7 46	4 41	20 45 21	13 21	18 2 39	40.1	16 16
S	30	5 43	5 59	7 45	4 43	20 49 28	13 31	17 46 29	40.9	16 16
♄	31	6 18	6 37	7 43	4 45	20 53 34	13 41	17 29 59s	41.6	16 16

FEBRUARY.

D. of W.	D. of M.	High Water London morn.	High Water Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Add.	The Sun's Declination at Noon.	Diff. of ⊙'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s	m. s.	° ′ ″	″	′ ″
M	1	7 0	7 23	7 42	4 46	20 57 39	13 49	17 13 11s	42.4	16 16
Tu	2	7 50	8 21	7 41	4 48	21 1 44	13 57	16 56 4	43.2	16 16
W	3	9 3	9 45	7 39	4 50	21 5 47	14 4	16 38 39	43.9	16 16
Th	4	10 27	11 9	7 37	4 52	21 9 50	14 11	16 20 57	44.6	16 15
F	5	11 49	——	7 35	4 54	21 13 52	14 16	16 2 59	45.3	16 15
S	6	0 25	0 55	7 34	4 55	21 17 54	14 21	15 44 43	46.0	16 15
♄	7	1 22	1 49	7 32	4 57	21 21 54	14 25	15 26 11	46.7	16 15
M	8	2 13	2 38	7 30	4 59	21 25 54	14 28	15 7 24	47.3	16 15
Tu	9	3 0	3 23	7 29	5 1	21 29 52	14 30	14 48 22	47.9	16 15
W	10	3 44	4 7	7 27	5 3	21 33 50	14 31	14 29 4	48.5	16 14
Th	11	4 28	4 49	7 25	5 4	21 37 48	14 32	14 9 32	49.1	16 14
F	12	5 9	5 30	7 23	5 6	21 41 44	14 32	13 49 47	49.7	16 14
S	13	5 51	6 11	7 22	5 7	21 45 40	14 31	13 29 47	50.3	16 14
♄	14	6 33	6 58	7 20	5 9	21 49 35	14 29	13 9 35	50.8	16 14
M	15	7 23	7 51	7 18	5 11	21 53 29	14 27	12 49 10	51.3	16 13
Tu	16	8 23	9 3	7 16	5 13	21 57 22	14 23	12 28 32	51.8	16 13
W	17	9 43	10 26	7 14	5 15	22 1 15	14 20	12 7 43	52.3	16 13
Th	18	11 8	11 47	7 12	5 17	22 5 6	14 15	11 46 42	52.8	16 13
F	19	——	0 23	7 10	5 19	22 8 58	14 9	11 25 31	53.2	16 13
S	20	0 51	1 13	7 8	5 21	22 12 48	14 3	11 4 8	53.7	16 12
♄	21	1 35	1 54	7 6	5 23	22 16 38	13 57	10 42 35	54.1	16 12
M	22	2 11	2 28	7 4	5 25	22 20 27	13 49	10 20 53	54.5	16 12
Tu	23	2 44	2 58	7 2	5 27	22 24 16	13 41	9 59 0	54.9	16 12
W	24	3 14	3 29	7 0	5 29	22 28 4	13 33	9 36 59	55.2	16 12
Th	25	3 44	3 58	6 57	5 30	22 31 51	13 23	9 14 49	55.6	16 11
F	26	4 12	4 28	6 55	5 32	22 35 38	13 14	8 52 31	55.9	16 11
S	27	4 43	4 59	6 53	5 33	22 39 24	13 3	8 30 4	56.3	16 11
♄	28	5 15	5 32	6 52	5 35	22 43 9	12 52	8 7 30	56.6	16 11
M	29	5 50	6 9	6 50	5 37	22 46 55	12 41	7 44 49s	56.9	16 10

JANUARY.

D. of W.	D. of M.	High Water London morn.	High Water Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Add.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
F	1	6 15	6 34	8 8	4 0	18 45 15	3 38	23 2 52s	12.0	16 18
S	2	6 54	7 16	8 8	4 1	18 49 40	4 6	22 57 52	13.1	16 18
☉	3	7 40	8 8	8 8	4 2	18 54 4	4 34	22 52 24	14.2	16 18
M	4	8 42	9 17	8 8	4 3	18 58 28	5 2	22 46 29	15.4	16 18
Tu	5	9 53	10 30	8 8	4 3	19 2 52	5 29	22 40 6	16.5	16 18
W	6	11 9	11 44	8 7	4 4	19 7 16	5 56	22 33 17	17.6	16 18
Th	7	——	0 15	8 7	4 6	19 11 39	6 23	22 26 1	18.7	16 18
F	8	0 44	1 10	8 7	4 7	19 16 1	6 49	22 18 18	19.8	16 18
S	9	1 37	2 2	8 6	4 9	19 20 23	7 14	22 10 9	20.9	16 18
☉	10	2 26	2 51	8 6	4 10	19 24 45	7 39	22 1 34	22.0	16 18
M	11	3 15	3 39	8 5	4 11	19 29 6	8 3	21 52 33	23.1	16 18
Tu	12	4 1	4 25	8 4	4 13	19 33 26	8 27	21 43 7	24.1	16 18
W	13	4 50	5 12	8 3	4 14	19 37 46	8 50	21 33 16	25.2	16 18
Th	14	5 34	5 57	8 2	4 16	19 42 5	9 13	21 22 59	26.2	16 18
F	15	6 19	6 42	8 2	4 18	19 46 23	9 34	21 12 18	27.2	16 18
S	16	7 6	7 30	8 1	4 19	19 50 41	9 55	21 1 13	28.2	16 18
☉	17	7 59	8 32	8 0	4 21	19 54 57	10 16	20 49 43	29.2	16 18
M	18	9 9	9 46	7 59	4 22	19 59 14	10 35	20 37 50	30.2	16 18
Tu	19	10 25	11 4	7 58	4 24	20 3 29	10 54	20 25 34	31.2	16 17
W	20	11 43	——	7 57	4 25	20 7 44	11 13	20 12 54	32.1	16 17
Th	21	0 15	0 44	7 56	4 27	20 11 58	11 30	19 59 52	33.1	16 17
F	22	1 10	1 33	7 55	4 29	20 16 11	11 47	19 46 28	34.0	16 17
S	23	1 55	2 14	7 54	4 31	20 20 23	12 2	19 32 41	34.9	16 17
☉	24	2 33	2 50	7 53	4 33	20 24 35	12 17	19 18 33	35.8	16 17
M	25	3 6	3 23	7 51	4 35	20 28 46	12 32	19 4 3	36.7	16 17
Tu	26	3 39	3 53	7 50	4 37	20 32 56	12 45	18 49 13	37.6	16 17
W	27	4 9	4 24	7 48	4 39	20 37 5	12 58	18 34 2	38.4	16 17
Th	28	4 39	4 55	7 47	4 40	20 41 14	13 10	18 18 30	39.2	16 17
F	29	5 11	5 26	7 46	4 41	20 45 21	13 21	18 2 39	40.1	16 16
S	30	5 43	5 59	7 45	4 43	20 49 28	13 31	17 46 29	40.9	16 16
☉	31	6 18	6 37	7 43	4 45	20 53 34	13 41	17 29 59s	41.6	16 16

FEBRUARY.

D. of W.	D. of M.	High Water London morn.	High Water Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Add.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s	m. s.	° ′ ″	″	′ ″
M	1	7 0	7 23	7 42	4 46	20 57 39	13 49	17 13 11s	42.4	16 16
Tu	2	7 50	8 21	7 41	4 48	21 1 44	13 57	16 56 4	43.2	16 16
W	3	9 3	9 45	7 39	4 50	21 5 47	14 4	16 38 39	43.9	16 16
Th	4	10 27	11 9	7 37	4 52	21 9 50	14 11	16 20 57	44.6	16 15
F	5	11 49	——	7 35	4 54	21 13 52	14 16	16 2 59	45.3	16 15
S	6	0 25	0 55	7 34	4 55	21 17 54	14 21	15 44 43	46.0	16 15
☉	7	1 22	1 49	7 32	4 57	21 21 54	14 25	15 26 11	46.7	16 15
M	8	2 13	2 38	7 30	4 59	21 25 54	14 28	15 7 24	47.3	16 15
Tu	9	3 0	3 23	7 29	5 1	21 29 52	14 30	14 48 22	47.9	16 15
W	10	3 44	4 7	7 27	5 3	21 33 50	14 31	14 29 4	48.5	16 14
Th	11	4 28	4 49	7 25	5 4	21 37 48	14 32	14 9 32	49.1	16 14
F	12	5 9	5 30	7 23	5 6	21 41 44	14 32	13 49 47	49.7	16 14
S	13	5 51	6 11	7 22	5 7	21 45 40	14 31	13 29 47	50.3	16 14
☉	14	6 33	6 58	7 20	5 9	21 49 35	14 29	13 9 35	50.8	16 14
M	15	7 23	7 51	7 18	5 11	21 53 29	14 27	12 49 10	51.3	16 13
Tu	16	8 23	9 3	7 16	5 13	21 57 22	14 23	12 28 32	51.8	16 13
W	17	9 43	10 26	7 14	5 15	22 1 15	14 20	12 7 43	52.3	16 13
Th	18	11 8	11 47	7 12	5 17	22 5 6	14 15	11 46 42	52.8	16 13
F	19	——	0 23	7 10	5 19	22 8 58	14 9	11 25 31	53.2	16 13
S	20	0 51	1 13	7 8	5 21	22 12 48	14 3	11 4 8	53.7	16 12
☉	21	1 35	1 54	7 6	5 23	22 16 38	13 57	10 42 35	54.1	16 12
M	22	2 11	2 28	7 4	5 25	22 20 27	13 49	10 20 53	54.5	16 12
Tu	23	2 44	2 58	7 2	5 27	22 24 16	13 41	9 59 0	54.9	16 12
W	24	3 14	3 29	7 0	5 29	22 28 4	13 33	9 36 59	55.2	16 12
Th	25	3 44	3 58	6 57	5 30	22 31 51	13 23	9 14 49	55.6	16 11
F	26	4 12	4 28	6 55	5 32	22 35 38	13 14	8 52 31	55.9	16 11
S	27	4 43	4 59	6 53	5 33	22 39 24	13 3	8 30 4	56.3	16 11
☉	28	5 15	5 32	6 52	5 35	22 43 9	12 52	8 7 30	56.6	16 11
M	29	5 50	6 9	6 50	5 37	22 46 55	12 41	7 44 49s	56.9	16 10

MARCH.

D. of W.	D. of M.	High Water London Bridge morn.	High Water London Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Add.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
Tu	1	6 30	6 54	6 48	5 39	22 50 39	12 29	7 22 1S	57.1	16 10
W	2	7 20	7 51	6 46	5 40	22 54 23	12 16	6 59 7	57·4	16 10
Th	3	8 28	9 13	6 44	5 42	22 58 7	12 4	6 36 7	57·6	16 10
F	4	10 1	10 46	6 42	5 43	23 1 50	11 50	6 13 1	57·9	16 9
S	5	11 30	——	6 39	5 45	23 5 33	11 37	5 49 50	58·1	16 9
☉	6	0 7	0 38	6 37	5 47	23 9 15	11 22	5 26 34	58·3	16 9
M	7	1 5	1 30	6 35	5 49	23 12 57	11 8	5 3 14	58·4	16 9
Tu	8	1 54	2 17	6 33	5 51	23 16 39	10 53	4 39 49	58·6	16 8
W	9	2 39	3 0	6 30	5 52	23 20 20	10 38	4 16 22	58·7	16 8
Th	10	3 22	3 44	6 27	5 54	23 24 1	10 22	3 52 51	58·8	16 8
F	11	4 5	4 25	6 25	5 56	23 27 42	10 6	3 29 17	58·9	16 7
S	12	4 45	5 4	6 22	5 58	23 31 22	9 50	3 5 41	59·0	16 7
☉	13	5 25	5 44	6 20	5 59	23 35 2	9 33	2 42 3	59·1	16 7
M	14	6 7	6 28	6 17	6 1	23 38 42	9 16	2 18 24	59·2	16 7
Tu	15	6 53	7 17	6 15	6 3	23 42 21	8 59	1 54 43	59·2	16 6
W	16	7 47	8 22	6 12	6 5	23 46 0	8 42	1 31 1	59·2	16 6
Th	17	9 3	9 45	6 10	6 7	23 49 39	8 24	1 7 19	59·3	16 6
F	18	10 27	11 9	6 8	6 9	23 53 18	8 6	0 43 37	59·3	16 6
S	19	11 46	——	6 6	6 11	23 56 57	7 48	0 19 55S	59·2	16 5
☉	20	0 18	0 42	6 4	6 13	0 0 35	7 30	0 3 47N	59·2	16 5
M	21	1 3	1 23	6 1	6 14	0 4 13	7 12	0 27 27	59·2	16 5
Tu	22	1 41	1 58	5 59	6 16	0 7 51	6 53	0 51 6	59·1	16 5
W	23	2 13	2 28	5 56	6 17	0 11 29	6 35	1 14 44	59·0	16 4
Th	24	2 43	2 59	5 54	6 19	0 15 8	6 17	1 38 20	58·9	16 4
F	25	3 13	3 31	5 52	6 20	0 18 46	5 58	2 1 54	58·8	16 4
S	26	3 45	4 1	5 49	6 22	0 22 24	5 39	2 25 25	58·7	16 3
☉	27	4 18	4 35	5 47	6 23	0 26 1	5 21	2 48 53	58·6	16 3
M	28	4 53	5 10	5 44	6 25	0 29 40	5 2	3 12 17	58·5	16 3
Tu	29	5 30	5 49	5 42	6 26	0 33 18	4 44	3 35 39	58·3	16 3
W	30	6 13	6 38	5 40	6 28	0 36 56	4 26	3 58 56	58·1	16 2
Th	31	7 5	7 38	5 37	6 30	0 40 34	4 7	4 22 9N	57·9	16 2

APRIL.

D. of W.	D. of M.	High Water London Bridge morn.	High Water London Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Add.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m s.	° ′ ″	″	′ ″
F	1	8 15	9 2	5 36	6 33	0 44 12	3 49	4 45 17N	57·7	16 2
S	2	9 45	10 30	5 34	6 35	0 47 51	3 31	5 8 20	57·5	16 1
☉	3	11 12	11 46	5 32	6 37	0 51 30	3 13	5 31 18	57·3	16 1
M	4	——	0 17	5 29	6 38	0 55 8	2 55	5 54 10	57·0	16 1
Tu	5	0 44	1 8	5 27	6 39	0 58 48	2 38	6 16 56	56·8	16 1
W	6	1 33	1 54	5 25	6 41	1 2 27	2 21	6 39 36	56·5	16 0
Th	7	2 15	2 38	5 23	6 42	1 6 6	2 4	7 2 9	56·2	16 0
F	8	2 59	3 20	5 22	6 44	1 9 46	1 47	7 24 34	55·9	16 0
S	9	3 41	4 0	5 20	6 46	1 13 26	1 30	7 46 52	55·6	16 0
☉	10	4 21	4 40	5 18	6 47	1 17 6	1 14	8 9 2	55·2	15 59
M	11	4 59	5 19	5 16	6 49	1 20 46	0 57	8 31 4	54·9	15 59
Tu	12	5 40	6 2	5 13	6 50	1 24 27	0 42	8 52 57	54·5	15 59
W	13	6 25	6 50	5 10	6 52	1 28 8	0 26	9 14 42	54·1	15 58
Th	14	7 15	7 47	5 7	6 54	1 31 49	0 11	9 36 17	53·8	15 58
F	15	8 22	9 1	5 5	6 55	1 35 31	Sub. 4	9 57 42	53·3	15 58
S	16	9 40	10 17	5 3	6 57	1 39 13	0 19	10 18 58	52·9	15 58
☉	17	10 53	11 27	5 1	6 58	1 42 55	0 33	10 40 3	52·5	15 57
M	18	11 57	——	4 59	7 0	1 46 38	0 47	11 0 58	52·0	15 57
Tu	19	0 21	0 42	4 57	7 2	1 50 21	1 0	11 12 41	51·6	15 57
W	20	1 1	1 19	4 55	7 3	1 54 5	1 13	11 42 14	51·1	15 57
Th	21	1 38	1 54	4 53	7 5	1 57 49	1 26	12 2 35	50·6	15 56
F	22	2 12	2 28	4 51	7 6	2 1 33	1 38	12 22 44	50·1	15 56
S	23	2 46	3 3	4 49	7 8	2 5 18	1 50	12 42 41	49·6	15 56
☉	24	3 21	3 38	4 47	7 10	2 9 3	2 1	13 2 26	49·1	15 56
M	25	3 57	4 15	4 45	7 11	2 12 49	2 12	13 21 58	48·6	15 55
Tu	26	4 34	4 56	4 43	7 13	2 16 35	2 22	13 41 17	48·0	15 55
W	27	5 15	5 38	4 41	7 14	2 20 22	2 31	14 0 22	47·4	15 55
Th	28	6 3	6 31	4 39	7 16	2 24 10	2 41	14 19 14	46·9	15 54
F	29	6 59	7 32	4 37	7 18	2 27 57	2 49	14 37 51	46·3	15 54
S	30	8 9	8 50	4 35	7 20	2 31 46	2 57	14 56 14N	45·7	15 54

MAY.

D. of W.	D. of M.	High Water London morn.	High Water Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Sub.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
♄	1	9 31	10 9	4 33	7 22	2 35 35	3 5	15 14 23N	45.0	15 54
M	2	10 46	11 20	4 31	7 24	2 39 24	3 12	15 32 16	44.4	15 54
Tu	3	11 50	——	4 29	7 25	2 43 15	3 18	15 49 55	43.8	15 53
W	4	0 18	0 44	4 28	7 26	2 47 5	3 24	16 7 17	43.1	15 53
Th	5	1 9	1 34	4 26	7 27	2 50 57	3 30	16 24 24	42.4	15 53
F	6	1 58	2 18	4 25	7 29	2 54 48	3 34	16 41 14	41.7	15 53
S	7	2 40	3 0	4 23	7 30	2 58 41	3 38	16 57 17	41.0	15 52
♄	8	3 22	3 40	4 21	7 32	3 2 34	3 42	17 14 4	40.3	15 52
M	9	4 0	4 20	4 20	7 33	3 6 27	3 45	17 30 3	39.6	15 52
Tu	10	4 39	4 59	4 18	7 35	3 10 21	3 48	17 45 45	38.9	15 52
W	11	5 20	5 38	4 16	7 37	3 14 16	3 49	18 1 9	38.1	15 52
Th	12	5 59	6 22	4 15	7 38	3 18 11	3 51	18 16 15	37.4	15 51
F	13	6 45	7 10	4 13	7 40	3 22 7	3 52	18 31 2	36.6	15 51
S	14	7 37	8 7	4 12	7 42	3 26 3	3 52	18 45 31	35.8	15 51
♄	15	8 43	9 18	4 11	7 43	3 30 0	3 52	18 59 40	35.0	15 51
M	16	9 51	10 22	4 10	7 45	3 33 58	3 51	19 13 31	34.2	15 51
Tu	17	10 56	11 26	4 8	7 46	3 37 55	3 49	19 27 2	33.4	15 51
W	18	11 54	——	4 7	7 47	3 41 51	3 47	19 40 12	32.5	15 50
Th	19	0 17	0 38	4 5	7 49	3 45 53	3 45	19 53 3	31.7	15 50
F	20	0 59	1 20	4 3	7 50	3 49 53	3 42	20 5 34	30.9	15 50
S	21	1 41	2 2	4 2	7 52	3 53 52	3 38	20 17 44	30.0	15 50
♄	22	2 20	2 40	4 0	7 53	3 57 53	3 34	20 29 34	29.1	15 50
M	23	2 58	3 19	3 59	7 55	4 1 55	3 30	20 41 2	28.3	15 49
Tu	24	3 39	4 0	3 58	7 57	4 5 56	3 24	20 52 9	27.4	15 49
W	25	4 22	4 45	3 57	7 58	4 9 59	3 19	21 2 55	26.5	15 49
Th	26	5 6	5 31	3 56	7 59	4 14 1	3 13	21 13 19	25.6	15 49
F	27	5 57	6 24	3 55	8 0	4 18 5	3 6	21 23 21	24.6	15 49
S	28	6 54	7 26	3 55	8 1	4 22 8	2 59	21 33 1	23.7	15 49
♄	29	7 59	8 32	3 54	8 2	4 26 12	2 51	21 42 18	22.8	15 48
M	30	9 7	9 43	3 53	8 2	4 30 17	2 43	21 51 14	21.8	15 48
Tu	31	10 18	10 49	3 52	8 3	4 34 22	2 34	21 59 46N	20.9	15 48

JUNE.

D. of W.	D. of M.	High Water London morn.	High Water Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Sub.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
W	1	11 20	11 52	3 52	8 5	4 38 28	2 25	22 7 55N	19.9	15 48
Th	2	——	0 20	3 51	8 5	4 42 34	2 16	22 15 41	19.0	15 48
F	3	0 48	1 14	3 50	8 6	4 46 40	2 6	22 23 4	18.0	15 48
S	4	1 38	2 1	3 49	8 7	4 50 47	1 56	22 30 4	17.0	15 48
♄	5	2 25	2 46	3 49	8 8	4 54 54	1 46	22 36 40	16.0	15 48
M	6	3 4	3 25	3 48	8 8	4 59 1	1 35	22 42 52	15.0	15 47
Tu	7	3 41	4 2	3 47	8 9	5 3 9	1 24	22 48 41	14.0	15 47
W	8	4 21	4 38	3 47	8 10	5 7 17	1 12	22 54 5	13.0	15 47
Th	9	4 58	5 16	3 46	8 11	5 11 25	1 1	22 59 5	12.0	15 47
F	10	5 36	5 54	3 46	8 12	5 15 33	0 49	23 3 41	11.0	15 47
S	11	6 16	6 38	3 46	8 13	5 19 42	0 37	23 7 53	10.0	15 47
♄	12	6 59	7 22	3 46	8 13	5 23 51	0 25	23 11 40	9.0	15 47
M	13	7 47	8 17	3 45	8 14	5 27 59	0 12	23 15 3	7.9	15 47
Tu	14	8 41	9 21	3 45	8 14	5 32 9	Add 0	23 18 1	6.9	15 47
W	15	9 51	10 22	3 45	8 15	5 36 18	0 13	23 20 35	5.9	15 47
Th	16	10 53	11 24	3 45	8 15	5 40 27	0 26	23 22 44	4.9	15 47
F	17	11 54	——	3 45	8 16	5 44 37	0 38	23 24 28	3.8	15 47
S	18	0 20	0 45	3 45	8 17	5 48 46	0 51	23 25 47	2.8	15 46
♄	19	1 9	1 34	3 45	8 17	5 52 54	1 4	23 26 42	1.8	15 46
M	20	1 56	2 17	3 45	8 17	5 57 5	1 17	23 27 12	0.8	15 46
Tu	21	2 41	3 4	3 45	8 17	6 1 14	1 30	23 27 17	0.3	15 46
W	22	3 28	3 50	3 46	8 18	6 5 24	1 43	23 26 57	1.3	15 46
Th	23	4 12	4 35	3 46	8 18	6 9 33	1 56	23 26 13	2.4	15 46
F	24	4 57	5 23	3 46	8 18	6 13 42	2 8	23 25 4	3.4	15 46
S	25	5 49	6 15	3 47	8 18	6 17 52	2 21	23 23 30	4.4	15 46
♄	26	6 40	7 8	3 47	8 18	6 22 1	2 34	23 21 31	5.5	15 46
M	27	7 36	8 7	3 47	8 18	6 26 10	2 46	23 19 7	6.5	15 46
Tu	28	8 37	9 13	3 48	8 18	6 30 18	2 58	23 16 19	7.5	15 46
W	29	9 48	10 21	3 49	8 17	6 34 27	3 10	23 13 7	8.5	15 46
Th	30	10 56	11 30	3 49	8 17	6 38 36	3 22	23 9 30N	9.6	15 46

JULY.

D. of W.	D. of M.	High Water London Bridge morn.	High Water London Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Add.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
F	1	——	0 2	3 50	8 17	6 42 44	3 34	23 5 29N	10·6	15 46
S	2	0 32	0 58	3 50	8 17	6 46 52	3 45	23 1 3	11·6	15 46
☉	3	1 24	1 48	3 51	8 16	6 50 59	3 57	22 56 13	12·6	15 46
M	4	2 10	2 31	3 52	8 15	6 55 7	4 7	22 51 0	13·6	15 46
Tu	5	2 52	3 11	3 53	8 14	6 59 14	4 18	22 45 23	14·6	15 46
W	6	3 29	3 46	3 54	8 14	7 3 21	4 28	22 39 31	15·5	15 46
Th	7	4 2	4 20	3 55	8 13	7 7 27	4 38	22 32 57	16·5	15 46
F	8	4 37	4 54	3 56	8 13	7 11 33	4 47	22 26 9	17·5	15 46
S	9	5 11	5 28	3 57	8 12	7 15 39	4 56	22 18 58	18·5	15 46
☉	10	5 45	6 4	3 58	8 12	7 19 44	5 5	22 11 23	19·4	15 46
M	11	6 23	6 44	3 59	8 11	7 23 48	5 13	22 3 26	20·4	15 46
Tu	12	7 5	7 27	4 0	8 11	7 27 52	5 21	21 55 6	21·3	15 46
W	13	7 52	8 20	4 1	8 10	7 31 56	5 28	21 46 24	22·2	15 46
Th	14	8 55	9 30	4 2	8 9	7 35 59	5 34	21 37 20	23·2	15 46
F	15	10 4	10 38	4 3	8 9	7 40 2	5 40	21 27 53	24·1	15 46
S	16	11 14	11 48	4 4	8 8	7 44 4	5 46	21 18 4	25·0	15 46
☉	17	——	0 17	4 5	8 7	7 48 6	5 51	21 7 54	25·9	15 47
M	18	0 46	1 12	4 6	8 6	7 52 7	5 56	20 57 22	26·8	15 47
Tu	19	1 38	2 2	4 7	8 5	7 56 8	6 0	20 46 30	27·7	15 47
W	20	2 25	2 51	4 8	8 3	8 0 8	6 3	20 35 16	28 5	15 47
Th	21	3 15	3 39	4 9	8 2	8 4 7	6 6	20 23 41	29·4	15 47
F	22	4 0	4 22	4 11	8 0	8 8 6	6 9	20 11 46	30·2	15 47
S	23	4 46	5 8	4 12	7 59	8 12 4	6 10	19 59 30	31·1	15 47
☉	24	5 30	5 55	4 13	7 57	8 16 2	6 12	19 46 54	31·9	15 47
M	25	6 18	6 42	4 15	7 56	8 20 0	6 12	19 33 59	32·7	15 47
Tu	26	7 7	7 35	4 16	7 54	8 23 56	6 12	19 20 44	33·5	15 47
W	27	8 5	8 38	4 18	7 53	8 27 52	6 12	19 7 9	34·3	15 47
Th	28	9 15	9 53	4 19	7 51	8 31 48	6 11	18 53 16	35·1	15 47
F	29	0 31	11 10	4 21	7 50	8 35 43	6 9	18 39 3	35·9	15 48
S	30	1 45	——	4 23	7 48	8 39 37	6 7	18 24 33	36·7	15 48
☉	31	0 18	0 46	4 24	7 48	8 43 31	6 4	18 9 44N	37·4	15 48

AUGUST.

D. of W.	D. of M.	High Water London Bridge morn.	High Water London Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Add.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m s.	° ′ ″	″	′ ″
M	1	1 13	1 36	4 26	7 45	8 47 24	6 1	17 54 37N	38·2	15 48
Tu	2	1 55	2 15	4 27	7 43	8 51 17	5 57	17 39 13	38·9	15 48
W	3	2 34	2 52	4 28	7 42	8 55 9	5 52	17 23 32	39·6	15 48
Th	4	3 9	3 25	4 30	7 40	8 59 0	5 47	17 7 33	40·3	15 48
F	5	3 40	3 56	4 32	7 39	9 2 51	5 41	16 51 18	41·0	15 49
S	6	4 10	4 27	4 33	7 38	9 6 41	5 35	16 34 47	41·6	15 49
☉	7	4 42	4 58	4 35	7 37	9 10 30	5 28	16 17 59	42·3	15 49
M	8	5 13	5 28	4 36	7 36	9 14 19	5 20	16 0 56	43·0	15 49
Tu	9	5 46	6 5	4 38	7 34	9 18 8	5 12	15 43 38	43·6	15 49
W	10	6 23	6 45	4 39	7 30	9 21 55	5 3	15 26 5	44·2	15 49
Th	11	7 7	7 34	4 41	7 28	9 25 42	4 54	15 8 16	44·8	15 49
F	12	8 3	8 40	4 42	7 26	9 29 29	4 44	14 50 14	45·4	15 50
S	13	9 21	9 59	4 44	7 24	9 33 15	4 33	14 31 57	46·0	15 50
☉	14	10 42	11 22	4 45	7 22	9 37 0	4 22	14 13 26	46·6	15 50
M	15	11 57	——	4 47	7 20	9 40 45	4 11	13 54 42	47·1	15 50
Tu	16	0 26	0 55	4 48	7 18	9 44 30	3 58	13 35 44	47·7	15 50
W	17	1 21	1 46	4 50	7 16	9 48 14	3 46	13 16 34	48·2	15 51
Th	18	2 10	2 35	4 51	7 14	9 51 57	3 32	12 57 11	48·7	15 51
F	19	2 58	3 19	4 53	7 12	9 55 40	3 19	12 37 35	49·2	15 51
S	20	3 42	4 2	4 55	7 10	9 59 22	3 5	12 17 48	49·7	15 51
☉	21	4 23	4 48	4 56	7 8	10 3 4	2 50	11 57 48	50·2	15 51
M	22	5 10	5 32	4 58	7 6	10 6 46	2 35	11 37 37	50·7	15 52
Tu	23	5 54	6 17	4 59	7 4	10 10 27	2 19	11 17 15	51·1	15 52
W	24	6 42	7 7	5 1	7 2	10 14 7	2 4	10 56 42	51·6	15 52
Th	25	7 34	8 5	5 3	7 0	10 17 48	1 47	10 35 59	52·0	15 52
F	26	8 42	9 26	5 4	6 58	10 21 28	1 31	10 15 5	52·4	15 52
S	27	10 6	10 45	5 6	6 56	10 25 7	1 14	9 54 2	52·8	15 53
☉	28	11 23	11 59	5 8	6 54	10 28 46	0 56	9 32 48	53·2	15 53
M	29	——	0 28	5 9	6 52	10 32 25	0 38	9 11 26	53·6	15 53
Tu	30	0 54	1 16	5 10	6 49	10 36 4	0 20	8 49 55	54·0	15 53
W	31	1 36	1 53	5 12	6 47	10 39 42	0 2	8 28 16S	54·3	15 53

SEPTEMBER.

D. of W.	D. of M.	High Water London morn.	High Water London aftern.	High Water Bridge morn.	High Water Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Sub.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
Th	1	2 10	2 26	5 15	6 44	10 43 20	0 17	8 6 28N	54.6	15 54
F	2	2 44	2 59	5 16	6 42	10 46 57	0 36	7 44 32	55.0	15 54
S	3	3 13	3 28	5 17	6 40	10 50 35	0 55	7 22 29	55.3	15 54
☉	4	3 43	3 57	5 18	6 38	10 54 12	1 14	7 0 19	55.6	15 54
M	5	4 14	4 28	5 20	6 36	10 57 48	1 34	6 38 2	55.8	15 55
Tu	6	4 43	4 59	5 22	6 34	11 1 25	1 54	6 15 38	56.1	15 55
W	7	5 15	5 32	5 23	6 32	11 5 1	2 14	5 53 8	56.4	15 55
Th	8	5 52	6 12	5 25	6 30	11 8 38	2 35	5 30 33	56.6	15 55
F	9	6 35	7 1	5 27	6 28	11 12 14	2 55	5 7 52	56.8	15 56
S	10	7 31	8 6	5 28	6 25	11 15 49	3 16	4 45 6	57.0	15 56
☉	11	8 49	9 32	5 30	6 23	11 19 25	3 37	4 22 15	57.2	15 56
M	12	10 16	10 58	5 31	6 21	11 23 1	3 58	3 59 19	57.4	15 56
Tu	13	11 35	——	5 33	6 19	11 26 36	4 19	3 36 19	57.6	15 57
W	14	0 6	0 35	5 35	6 17	11 30 11	4 40	3 13 16	57.7	15 57
Th	15	1 3	1 27	5 36	6 14	11 33 47	5 1	2 50 9	57.9	15 57
F	16	1 48	2 11	5 38	6 12	11 37 22	5 22	2 26 58	58.0	15 58
S	17	2 34	2 56	5 39	6 9	11 40 57	5 44	2 3 45	58.1	15 58
☉	18	3 19	3 41	5 40	6 7	11 44 33	6 5	1 40 29	58.2	15 58
M	19	4 2	4 23	5 42	6 5	11 48 8	6 26	1 17 11	58.3	15 58
Tu	20	4 43	5 4	5 44	6 2	11 51 44	6 47	0 53 50	58.4	15 59
W	21	5 25	5 46	5 46	6 0	11 55 19	7 8	0 30 28	58.4	15 59
Th	22	6 10	6 35	5 48	5 58	11 58 55	7 29	0 7 5N	58.5	15 59
F	23	7 1	7 33	5 50	5 56	12 2 30	7 50	0 16 20S	58.5	15 59
S	24	8 8	8 51	5 51	5 54	12 6 6	8 10	0 39 45	58.5	16 0
☉	25	9 32	10 12	5 53	5 52	12 9 43	8 31	1 3 10	58.5	16 0
M	26	10 53	11 28	5 55	5 49	12 13 19	8 51	1 26 35	58.5	16 0
Tu	27	noon	——	5 57	5 47	12 16 55	9 11	1 50 0	58.5	16 0
W	28	0 24	0 44	5 59	5 45	12 20 32	9 31	2 13 24	58.5	16 1
Th	29	1 5	1 24	6 0	5 42	12 24 9	9 51	2 36 47	58.4	16 1
F	30	1 42	1 57	6 1	5 39	12 27 46	10 10	3 0 8S	58.3	16 1

OCTOBER.

D. of W.	D. of M.	High Water London morn.	High Water London aftern.	High Water Bridge morn.	High Water Bridge aftern.	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Sub.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m. s	m. s.	° ′ ″	″	′ ″
S	1	2 12	2 29	6 2	5 36	12 31 24	10 29	3 23 28S	58.3	16 2
☉	2	2 43	2 57	6 4	5 34	12 35 2	10 48	3 46 45	58.2	16 2
M	3	3 13	3 29	6 6	5 31	12 38 40	11 6	4 10 0	58.0	16 2
Tu	4	3 44	4 1	6 8	5 29	12 42 18	11 24	4 33 11	57.9	16 2
W	5	4 17	4 32	6 10	5 26	12 45 57	11 42	4 56 19	57.8	16 3
Th	6	4 50	5 9	6 12	5 24	12 49 36	11 59	5 19 24	57.6	16 3
F	7	5 29	5 52	6 13	5 22	12 53 16	12 16	5 42 24	57.4	16 3
S	8	6 14	6 42	6 15	5 19	12 56 56	12 33	6 5 20	57.2	16 4
☉	9	7 11	7 47	6 17	5 17	13 0 36	12 49	6 28 11	57.0	16 4
M	10	8 28	9 13	6 18	5 15	13 4 17	13 5	6 50 56	56.8	16 4
Tu	11	9 56	10 38	6 20	5 13	13 7 58	13 20	7 13 36	56.5	16 4
W	12	11 13	11 45	6 21	5 10	13 11 40	13 35	7 36 10	56.3	16 5
Th	13	——	0 14	6 23	5 8	13 15 23	13 49	7 58 38	56.0	16 5
F	14	0 40	1 3	6 25	5 6	13 19 5	14 3	8 20 59	55.7	16 5
S	15	1 26	1 48	6 26	5 4	13 22 49	14 16	8 43 13	55.4	16 5
☉	16	2 10	2 32	6 28	5 2	13 26 33	14 28	9 5 20	55.1	16 6
M	17	2 55	3 19	6 29	5 0	13 30 17	14 40	9 27 18	54.8	16 6
Tu	18	3 40	4 1	6 31	4 58	13 34 2	14 52	9 49 9	54.4	16 6
W	19	4 22	4 41	6 33	4 56	13 37 48	15 3	10 10 51	54.1	16 7
Th	20	5 1	5 23	6 35	4 54	13 41 34	15 13	10 32 25	53.7	16 7
F	21	5 46	6 11	6 37	4 52	13 45 22	15 22	10 53 49	53.3	16 7
S	22	6 36	7 2	6 38	4 50	13 49 9	15 31	11 15 3	52.9	16 7
☉	23	7 33	8 5	6 40	4 48	13 52 58	15 39	11 36 7	52.5	16 8
M	24	8 50	9 28	6 42	4 46	13 56 47	15 46	11 57 1	52.0	16 8
Tu	25	10 4	10 41	6 43	4 44	14 0 37	15 53	12 17 43	51.6	16 8
W	26	11 15	11 43	6 45	4 42	14 4 28	15 59	12 38 15	51.1	16 8
Th	27	——	0 7	6 47	4 40	14 8 19	16 4	12 58 34	50.6	16 9
F	28	0 29	0 48	6 49	4 38	14 12 11	16 8	13 18 42	50.1	16 9
S	29	1 7	1 25	6 51	4 37	14 16 4	16 12	13 38 37	49.5	16 9
☉	30	1 42	1 58	6 53	4 35	14 19 58	16 15	13 58 19	49.0	16 9
M	31	2 15	2 31	6 55	4 34	14 23 52	16 17	14 17 43S	48.4	17 0

NOVEMBER.

D. of W.	D. of M.	High Water London morn.	High Water London afternoon	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Sub.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
Tu	1	2 47	3 3	6 56	4 31	14 27 48	16 18	14 37 2s	47·8	16 10
W	2	3 21	3 38	6 58	4 29	14 31 44	16 19	14 56 3	47·2	16 10
Th	3	3 56	4 14	7 0	4 27	14 35 41	16 18	15 14 49	46·6	16 10
F	4	4 34	4 52	7 2	4 26	14 39 39	16 17	15 33 20	46·0	16 11
S	5	5 14	5 37	7 4	4 24	14 43 37	16 15	15 51 35	45·3	16 11
☉	6	6 1	6 30	7 6	4 22	14 47 36	16 12	16 9 35	44·7	16 11
M	7	6 58	7 31	7 7	4 21	14 51 37	16 9	16 27 18	44·0	16 11
Tu	8	8 10	8 51	7 8	4 19	14 55 38	16 4	16 44 44	43·3	16 12
W	9	9 31	10 8	7 10	4 18	14 59 39	15 59	17 1 54	42·5	16 12
Th	10	10 46	11 20	7 11	4 16	15 3 42	15 53	17 18 46	41·8	16 12
F	11	11 49	——	7 13	4 14	15 7 45	15 46	17 35 19	41·1	16 12
S	12	0 16	0 41	7 14	4 13	15 11 50	15 38	17 51 35	40·3	16 13
☉	13	1 7	1 30	7 16	4 11	15 15 55	15 30	18 7 32	39·5	16 13
M	14	1 54	2 17	7 18	4 10	15 20 1	15 20	18 23 10	38·7	16 13
Tu	15	2 38	3 0	7 20	4 9	15 24 8	15 10	18 38 29	37·9	16 13
W	16	3 21	3 42	7 22	4 7	15 28 15	14 59	18 53 27	37·0	16 14
Th	17	4 2	4 23	7 23	4 6	15 32 24	14 47	19 8 6	36·2	16 14
F	18	4 42	5 3	7 25	4 5	15 36 33	14 34	19 22 24	35·3	16 14
S	19	5 25	5 47	7 27	4 4	15 40 44	14 20	19 36 21	34·5	16 14
☉	20	6 9	6 31	7 29	4 3	15 44 55	14 6	19 49 57	33·6	16 14
M	21	6 54	7 21	7 31	4 1	15 49 7	13 51	20 3 11	32·7	16 14
Tu	22	7 52	8 28	7 32	4 0	15 53 19	13 34	20 16 3	31·7	16 15
W	23	9 1	9 34	7 34	3 59	15 57 33	13 18	20 28 33	30·8	16 15
Th	24	10 7	10 38	7 35	3 58	16 1 47	13 0	20 40 40	29·8	16 15
F	25	11 12	11 40	7 37	3 57	16 6 2	12 41	20 52 24	28·9	16 15
S	26	——	0 6	7 39	3 56	16 10 18	12 22	21 3 44	27·9	16 15
☉	27	0 28	0 50	7 40	3 55	16 14 35	12 2	21 14 41	26·9	16 15
M	28	1 9	1 28	7 41	3 54	16 18 52	11 41	21 25 14	25·9	16 16
Tu	29	1 48	2 6	7 43	3 53	16 23 10	11 20	21 35 22	24·8	16 16
W	30	2 27	2 46	7 44	3 53	16 27 29	10 58	21 45 5s	23·8	16 16

DECEMBER.

D. of W.	D. of M.	High Water London morn.	High Water Bridge afternoon	Sun rises at London.	Sun sets at London.	The Sun's Right Ascension.	Equat. of time. Sub.	The Sun's Declination at Noon.	Diff. of ☉'s dec. in 1 hour.	The Sun's Semi-diameter.
		h. m.	h. m.	h. m.	h. m.	h. m. s.	m. s.	° ′ ″	″	′ ″
Th	1	3 4	3 23	7 45	3 52	16 31 48	10 35	21 54 24s	22·8	16 16
F	2	3 43	4 3	7 47	3 52	16 36 8	10 12	22 3 17	21·7	16 16
S	3	4 24	4 44	7 48	3 51	16 40 28	9 48	22 11 45	20·6	16 16
☉	4	5 7	5 30	7 50	3 50	16 44 49	9 23	22 19 47	19·6	16 16
M	5	5 56	6 21	7 52	3 50	16 49 11	8 58	22 27 23	18·5	16 17
Tu	6	6 49	7 17	7 53	3 50	16 53 33	8 32	22 34 32	17·4	16 17
W	7	7 48	8 24	7 54	3 50	16 57 56	8 6	22 41 15	16·3	16 17
Th	8	9 1	9 36	7 55	3 49	17 2 19	7 40	22 47 32	15·1	16 17
F	9	10 14	10 48	7 56	3 49	17 6 42	7 13	22 53 21	14·0	16 17
S	10	11 24	11 53	7 57	3 49	17 11 6	6 46	22 58 43	12·9	16 17
☉	11	——	0 23	7 58	3 49	17 15 31	6 18	23 3 38	11·7	16 17
M	12	0 48	1 16	7 59	3 50	17 19 55	5 50	23 8 5	10·6	16 17
Tu	13	1 40	2 4	8 0	3 50	17 24 20	5 21	23 12 5	9·4	16 17
W	14	2 26	2 47	8 1	3 50	17 28 45	4 53	23 15 37	8·3	16 18
Th	15	3 9	3 29	8 2	3 50	17 33 11	4 24	23 18 42	7·1	16 18
F	16	3 48	4 9	8 2	3 51	17 37 37	3 54	23 21 18	5·9	16 18
S	17	4 26	4 44	8 3	3 51	17 42 3	3 25	23 23 26	4·8	16 18
☉	18	5 3	5 22	8 4	3 51	17 46 29	2 55	23 25 6	3·6	16 18
M	19	5 43	6 2	8 5	3 51	17 50 55	2 25	23 26 18	2·4	16 18
Tu	20	6 22	6 42	8 5	3 52	17 55 22	1 56	23 27 2	1·2	16 18
W	21	7 4	7 25	8 6	3 52	17 59 48	1 26	23 27 17	0·1	16 18
T	22	7 53	8 23	8 6	3 53	18 4 15	0 56	23 27 4	1·1	16 18
F	23	8 58	9 31	8 7	3 53	18 8 41	0 25	23 26 23	2·3	16 18
S	24	10 4	10 36	8 7	3 54	18 13 8	Add 5	23 25 13	3·5	16 18
☉	25	11 10	11 41	8 7	3 55	18 17 35	0 35	23 23 35	4·7	16 18
M	26	——	0 12	8 7	3 57	18 22 1	1 4	23 21 29	5·9	16 18
Tu	27	0 36	0 58	8 8	3 57	18 26 27	1 34	23 18 54	7·0	16 18
W	28	1 21	1 44	8 8	3 58	18 30 53	2 4	23 15 52	8·2	16 18
Th	29	2 6	2 28	8 8	3 58	18 35 19	2 33	23 12 22	9·4	16 18
F	30	2 49	3 10	8 8	3 58	18 39 45	3 2	23 8 23	10·5	16 18
S	31	3 32	3 52	8 8	3 59	18 44 10	3 31	23 3 57s	11·7	16 18

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